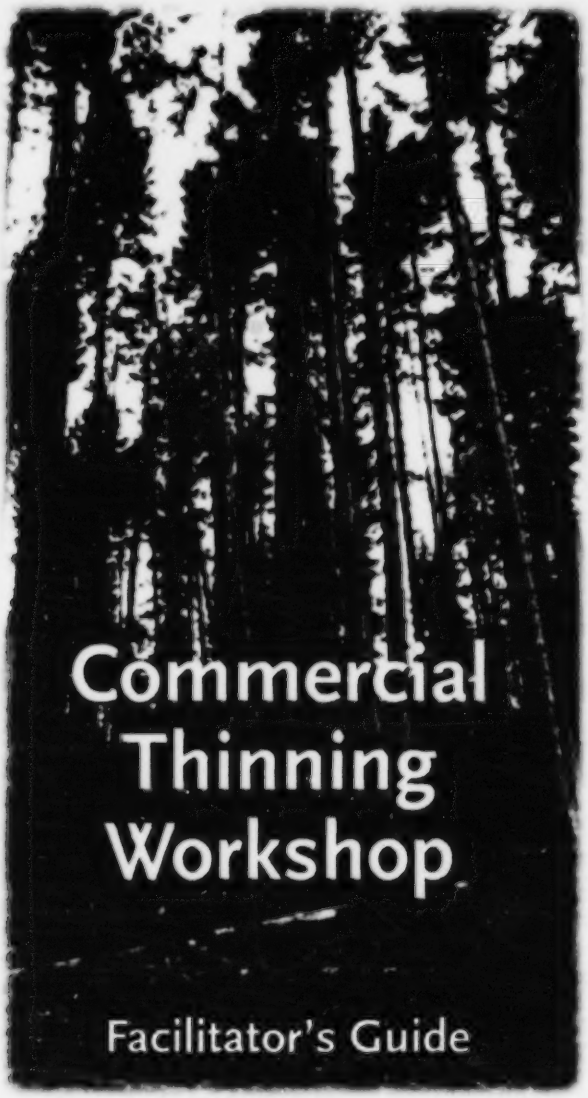

Commercial Thinning Workshop

Facilitator's Guide

FOREST RENEWAL BC

BRITISH COLUMBIA

Ministry of Forests
Forest Practices Branch

106-0 5783 /

Acknowledgements

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Instructions to the Facilitator

How to Use this Guide

You have been contracted to communicate the information included in this facilitator's guide to workshop participants. You must have the approval of the Ministry of Forests contact person before adding information or changing any portions of the intended message of this workshop.

The success of any workshop will depend on how well the facilitator selects activities to communicate the intended message to the participants. This guide is a complete package and should address the needs of most audiences. However, the care and thoroughness with which you plan and prepare for each workshop will make the difference between a mediocre and a successful event. Please review these materials carefully and enjoy your role in the learning process.

This guide is designed to help you prepare for and deliver this workshop.

The Workshop Introduction contains general information on the background, objectives, target audience and format for the workshop. Please read this information to ensure that you understand why and how this workshop was developed.

Lesson plans at the beginning of each lesson provide learning objectives, suggested delivery techniques and specific equipment and material requirements that you will have to coordinate. Each lesson contains explanatory information and copies of required overhead transparencies.

The participant's workbook has been created from the facilitator's guide. You should also review the workbook and become familiar with that material and the way in which it is presented.

Workshop Introduction

Purpose

The main purpose of this workshop is to provide participants with an overview of planning and operations for commercial thinning programs and projects through clarification of the use, intent and requirements of the *Commercial Thinning Guidelines* and associated legislation and regulations under the Forest Practices Code.

Specific Learning Objectives

Participants will:

- be introduced to the concepts and principles of commercial thinning
- learn the strategic purposes of commercial thinning
- review the basic conditions for using commercial thinning as an appropriate forest management tool
- learn to select, evaluate and rank stands for commercial thinning
- learn the main points of commercial thinning contract administration.

Target Audience

This workshop will be of interest and use to industry, government and consulting personnel responsible for preparing, implementing or monitoring prescriptions and contracts for commercial thinning.

Format

This commercial thinning workshop consists of six lessons. This workshop has been designed to cover one day but it could be expanded, where required, to two days during the field season for an audience with advanced needs for program and operations details. The facilitator's guide and participant's workbook include appendices of useful reference documents that provide an expanded foundation for program planning and project operations. The review and discussion of the appendices could be combined with a half-day field trip to view active operations or treated stands showing response.

Depending on the backgrounds and information needs of the participants, you, as the facilitator, may wish to minimize or even eliminate some of the lessons in the guide in order to concentrate on more relevant sections of the course to better meet the participants' needs. The time allotments for each lesson are suggestions for covering the entire course in seven hours. Note that the appendices include useful background information that has significant value for the participants, either as part of the workshop or as reference material for later use.

Various instructional techniques can be used to achieved the workshop objectives, including:

- lecturettes
- case studies
- group exercises
- class discussion.

Participant involvement throughout the workshop should be the focus. The role of the facilitator is to direct discussions and clarify points. Maintaining tight control over time during the exercises is an important task.

Materials

Materials included with this guide include:

- overhead transparencies for all lessons
- participant's workbook
- references.

The workshop is designed for a maximum of 20–24 participants per course. Including more participants may make the group difficult to manage and will reduce the value of the learning experience for everyone.

Facilitators

This workshop is designed to be delivered by one facilitator, who should be very familiar with the subject matter.

Instructions

Read through all of the materials in the facilitator's guide carefully and ensure that you are comfortable with the flow and the materials for all the workshop exercises. If you have any questions, please ask the Ministry of Forests contact person.

You should also review the following references:

- *Commercial Thinning Guidelines, Apritl 1999*, Ministry of Forests
- Technical references included with facilitator's guide

Lesson 1 Commercial Thinning – What is it?

Definition

60 minutes

Objectives:

1. To get people thinking about commercial thinning.
2. To define commercial thinning according to B.C. Ministry of Forests' policy.
3. To answer questions regarding commercial thinning within the range of silvicultural systems.
4. To discuss what commercial thinning can and cannot do.

Equipment Needs:

- flip chart
- overhead projector and screen

Method:

- lecturette

What is commercial thinning?

It is an intermediate harvest where:

- **the timber removed is sold for a profit, and**
- **there are no regeneration objectives.**

Overhead: **What is commercial thinning?**

Facilitator: In the introduction (pg. 1) to the *Commercial Thinning Guidebook*, commercial thinning is defined as an intermediate harvest where the wood removed is sold. It is further defined "as a thinning in which all or part of the felled trees are extracted for useful products" (from Smith 1986).

Ask: What products are we talking about?

Flip chart: Get the group to provide a list of possible products from CT.

- ▲ pulp roundwood
- ▲ small saw logs
- ▲ traditional sized saw logs
- ▲ specialty products such as fence posts, rails, mining timbers, grape stakes, hop poles, orchard props, Christmas trees(?)
- ▲ What about non-timber products? – not part of the definition of commercial thinning.

Note: Commercial thinning depends heavily on a market for your product!

The present view in B.C. is that CT is the first pass in a two-pass clearcut silvicultural system. The amount removed is measured three ways:

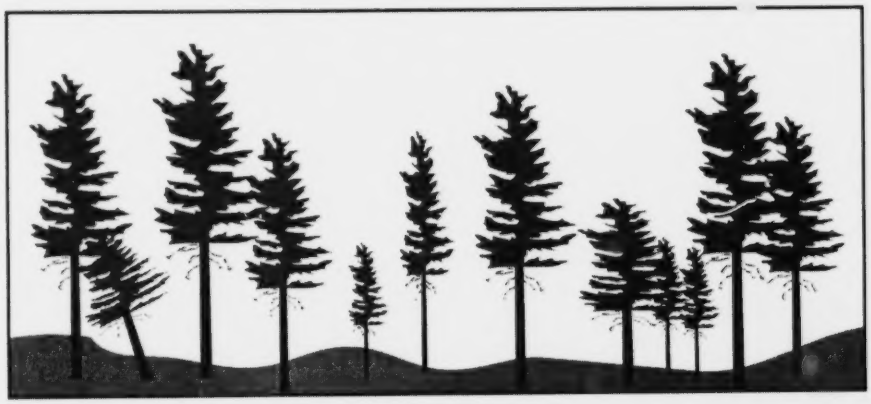
Go over these points – we will come back to these later when we talk about prescriptions and assessment procedures.

- ▲ Basal area removed – m^2/ha (40% removed is typical)
- ▲ Volume removed – m^3/ha (50–300 m^3/ha is typical)
- ▲ Number of stems removed – sph (leave stems specified)

Note: This is not to say that a stand could have more commercial thinning entries prior to a regeneration harvest. In Oregon and California (and Europe) it is not uncommon for 2–5 commercial thinnings to occur prior to the final harvest.

In B.C. CT has been, until now, a single entry cut in stands between 30 and 80 years old.

CT – When to use it



CT should be directed by higher level plans.

It should be done on stands:

- before rotation age (when it would be time for a regeneration cut), and
- after a portion of the stand, usually the smaller stems, become merchantable.

It is an intermediate entry, NOT a silvicultural system.

Overhead: **Commercial thinning – When to use it**

Facilitator: This overhead indicates when commercial thinning fits into a silvicultural system.

Use the overhead to promote discussion. Use a flip chart to summarize points.

1. Higher level plans are supposed to drive the use of CT.

Ask: Are there any examples in your operating area?

Soo TSA plan identifies the use of CT as a harvest method on a small proportion of the TSA each year. Specific objectives identified are:

- ▲ recover stand volume lost to mortality
- ▲ increase the merchantable volume recovered over a rotation – the total harvest volume including the thinned volume must not be less than the volume anticipated if the stand was untreated
- ▲ enhance total crop value
- ▲ increase employment
- ▲ where feasible the volume from commercial thinnings will be utilized to alleviate the age class distribution imbalance.

Three levels of plans can affect the use of CT:

i) the above higher level plan,

ii) the landscape unit plan can identify candidate areas, and

iii) forest development plans and silviculture prescriptions outline stand level objectives.

2. What do we mean when we say that CT is an intermediate entry and not a silvicultural system? Points to emphasize are:

- ▲ Once a stand has reached its rotation age – either biological (max MAI) or economic (usually younger than max MAI, or based on a target, such as piece size) – the block is ready to have a regeneration cut (in the past usually a clearcut). Thus old-growth stands are not suited to this cut without other reasons – anyone have any? Green-up adjacency, visuals, windfirming…
- ▲ For young stands, the stand has to be merchantable to allow an entry. If we are thinning from below, which reduces the chance of high grading, it is not until stands on good growth sites are 30+ years, and more on poorer sites. Thus the range is usually between 30 and 80 years old.

Objectives of CT

Overhead: **Commercial thinning – Objectives of CT**

Other overheads follow that can be used at the discretion of the facilitator to clarify points – they are found in the participant's workbook but may not be used if thought to be self explanatory or redundant.

Facilitator: "Turn to your neighbour" exercise. Have groups of two come up with a list of at least four things that commercial thinning can do for them. Record these on the overhead or flip chart.

Discussion: Discuss each point and determine whether it is true and to what extent the CT can meet the objectives they have described. Page 1 of the guidebook provides these examples:

- ▲ to obtain wood volume or revenue earlier than the usual harvest
- ▲ to improve the growth of residual trees
- ▲ to improve the stand quality by removing dead, diseased and deformed trees
- ▲ to capture some of the production that would be lost to competitive mortality.

The guidebook adds that CT is now used to:

- ▲ modify stand structure for wildlife habitat or biodiversity
- ▲ satisfy visual quality and 'green-up' constraints.

Get acquainted here with the issues – use the available overheads to flesh out issues that emerge. Use what you find useful – in some cases drawing on the flip chart or having a participant describe a situation or example will work best. Do what you think is right.

Points: Some points to cover...

1. Changing stands from even-aged to uneven-aged. Can CT be used to change even-aged stands into uneven-aged configurations? Yes, and it can be used in areas that are strictly even-aged today but are in areas where single tree selection would be considered an effective system to provide for the objectives of the site (e.g., constant high forest cover in retention VQO areas or in areas where structural diversity is an objective for stand and landscape level biodiversity). It may take

some time to convert the stand and will not necessarily be the most efficient timber production method, but it is a valid entry to achieve a range of objectives – **USE OH.**

- ▲ Where a silvicultural system with stem retention is contemplated, a commercial thinning entry could be used to help the remaining trees become more windfirm (reduce taper, add roots).
- ▲ It may be used to 'beetle proof' pine stands making them more vigourous and better able to pitch out beetles, as well as modifying the microclimate, confusing the beetles.
- ▲ Age class distributions at a landscape level can be manipulated using commercial thinning. Logging of stands now will often extend the length of time until similar volumes are available (if ever). Thus if there is a glut in the medium term and less wood available in the longer term, CT may help with the timber supply. It can also break up homogeneous forest cover for diversity objectives.

2. Can it provide more volume over time? If so only marginally – some estimates indicate a 10% increase is possible but to get that amount of increase great care must be taken to avoid damage to leave trees and to minimize detrimental disturbance. Therefore, in general, the answer is little to none – **USE OH.**
3. Can it provide a higher rate of return? Or does it make economic sense?
   - ▲ Page 2 of the guidebook indicates that the thinned plus unthinned stand should have a higher NPV than the untreated stand. Ask the group what this means.
   - ▲ Tell them we will go over this criteria in more detail later. In general it means leave a healthy, economically operable stand after your entry. If you can log at a profit now and leave a healthy intact stand you will likely have a positive NPV.

4. Can it smooth out timber supply shortages?
   How does it work? – ask the group.

Note: The guidebook suggests obtaining volumes early (e.g., 20 to 40 years ahead of schedule).

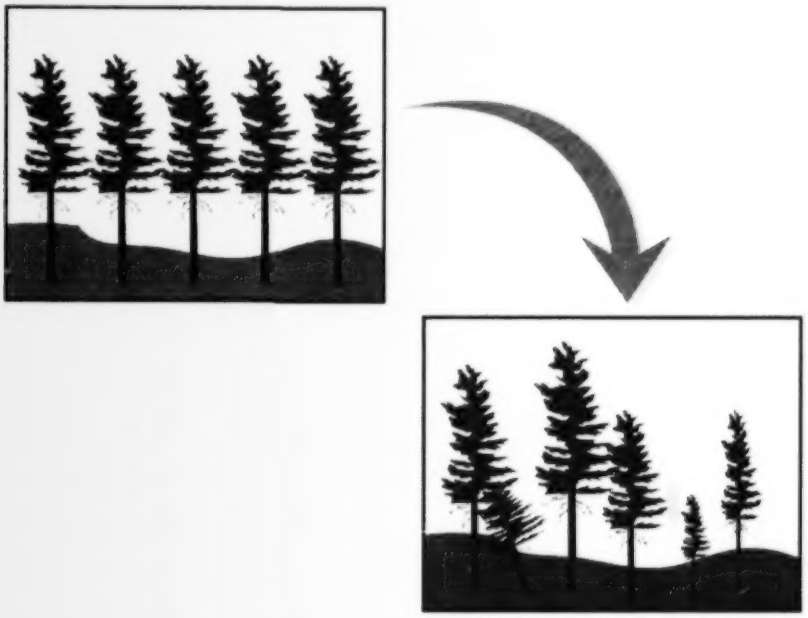
   ▲ The issue is different from using spacing to move stands towards merchantability sooner. With spacing, a larger average piece size is produced sooner than it otherwise would have been. This will allow for an earlier economic harvest and thus supply a remedy to timber shortfalls in the short term. Commercial thinning provides volume NOW to aid in present supply shortages, and may provide added economic wood in 20 to 40 years.

5. Requirements under the *FPC of BC Act* and regulations limit the size of clearcuts and require a certain amount of green-up to occur prior to harvesting adjacent (contiguous) areas. The specifics of this are outlined in the *Green-up Guidebook*. The key point for CT is that, if part of an uneven-aged silvicultural system, up to 60% of the basal area can be removed. If used as part of a shelterwood or seedtree system, and meets district manager approval, there is no specified limit as the green-up requirement is waived. For maximum block size there seems to be an opportunity to cut up to 60% of the basal area before the block adds to adjacent blocks for maximum block size (see page 5 of 1995 *Green-up Guidebook*). This may not always be possible but will likely be seen as a significant opportunity to harvest in areas with adjacency concerns.

   ▲ Ask if the group has any other points that they would like to add. Write them here for future reference.

Note: Use the overheads provided here to backup issues raised in this discussion. You can use them in any order. The topics will be covered at least once again so total comprehension may not be the goal at this point. Instead everyone should be thinking CT.

CT – What can it do for you?



It can:

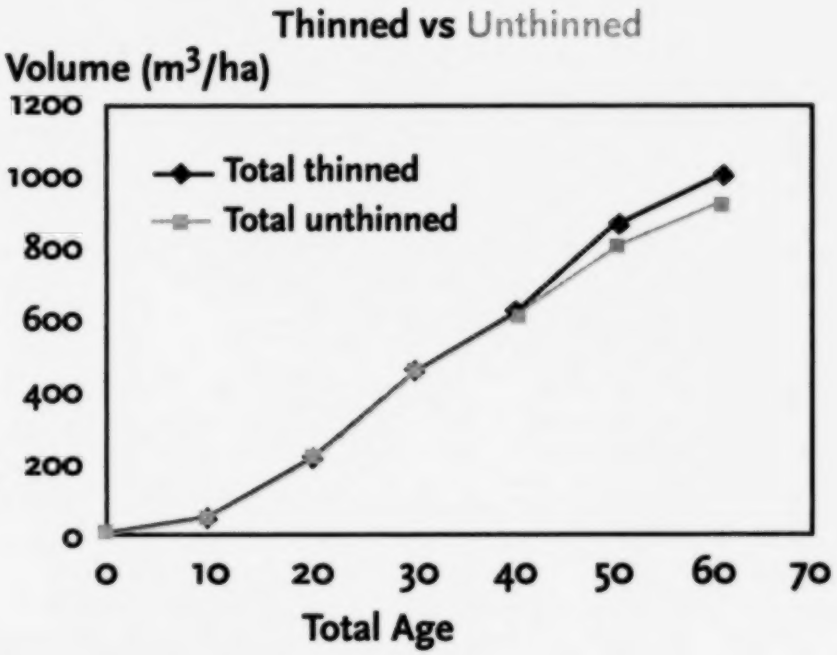
- **begin to convert even-aged stands into uneven-aged stands**
- **increase windfirmness in leave trees**
- **tackle forest health problems (e.g., "beetle proofing")**
- **break up age classes by extending rotation lengths.**

Overhead: **Commercial thinning – What can it do for you?**

Facilitator: Be sure the following points are covered. Ask the group whether anyone has experience using CT for these or any other reasons.

1. CT can be used to start the process of changing even-aged stands into uneven-aged stands. This may be accomplished by leaving the better trees to enhance their vigour. Future cuts would be for regeneration and would be deemed intermediate entries within a selection system.
2. When a partial cutting silvicultural system is prescribed to meet landscape level objectives, the stand may not be in a condition to absorb the brunt of a regeneration harvest. In some cases a commercial thin should be done to enhance windfirmness, add increment to the leave trees, and begin the selection of candidate leave trees.
3. In some lodgepole pine stands a commercial thin to reduce density may be used to reduce the possibility of a mountain pine beetle attack. This is called "beetle proofing" and is based on two theories.
   - ▲ One suggests the microenvironment in the stand is modified and the beetles search elsewhere for habitat.
   - ▲ The second proposes that the spaced trees will grow faster and be better equipped to pitch out beetles.
4. In some timber supply units there may be an overabundance of stands just coming to rotation. CT can harvest some stands just before normal rotation and some after normal rotation to spread out the cut. It can also modify homogenous stands into more diverse versions if desired at a landscape level.

Does commercial thinning provide more volume over time?



What are the key factors?

▲

▲

▲

The bottom line – no free wood with one entry.

Overhead: **Does commercial thinning provide more volume over time?**

Facilitator: Discuss the volume issue.

People quote the increase in volume from European (French Fd) stands as being up to 35% greater than if no thinnings had occurred. Testing by MoF Research Branch of these results showed a minor increase (approximately 10%) resulted from the numerous light thinnings (done about every five years).

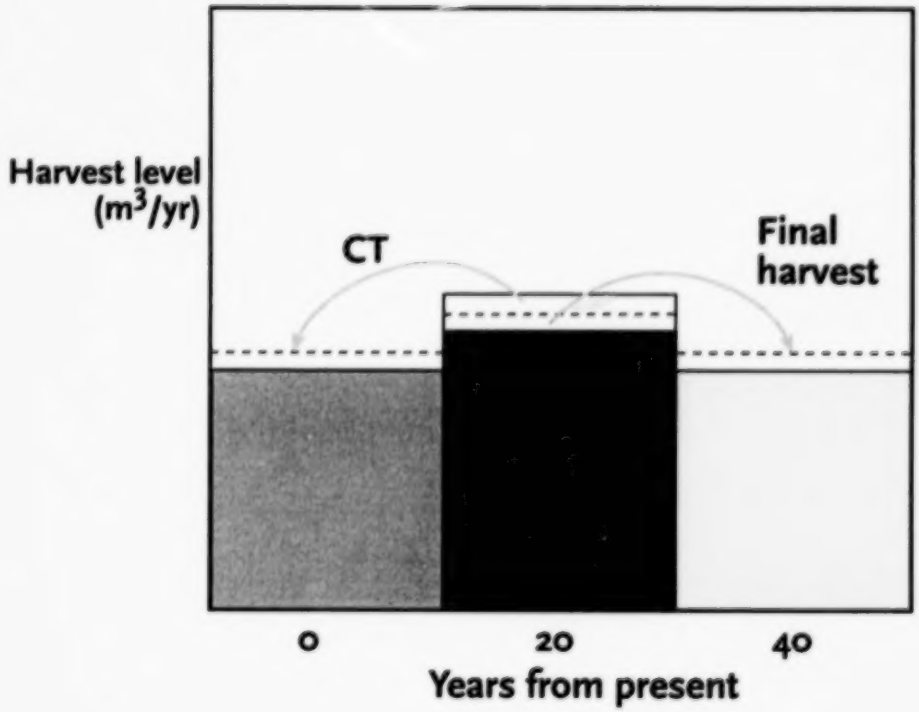
B.C. data from Shawnigan Lake thinning trials show minor 12 and 8% increases in total volume for Fd and Hw respectively with a single thinning. The results indicate that there was no difference in the largest 200 or so trees with CT. The average stand diameter was, however, increased by 24 and 14% respectively (Stone 1993 cites Omule 1988a and b).

Commercial thinning simply harvests some of tomorrow's wood today.

Write this on a flip chart page and post on the wall.

The opposite may not be true – that is – commercial thinning harvests *simply*, tomorrow's wood today.

Can commercial thinning smooth out timber supply shortages?



▲ If so, how does it work?

Overhead: **Can commercial thinning smooth out timber supply shortages?** (See page 3 in the *Commercial Thinning Guidebook* and *Forest Level Benefits to Commercial Thinning and Fertilization*, Feb. 1997. Prepared by Timberline Forest Inventory Consultants Ltd. for the Forest Practices Board.)

Facilitator: Discuss the following.

In areas where there are immediate supply problems – for example, where green-up adjacency is a significant limitation – CT may provide wood today at the expense of a reduced cut in the future.

The overhead shows the diagram used in the guidebook. It indicates that there is a shortfall now and in 40 years, in 20 years there is more wood available. The graph shows how some of that wood is used now, and how those stands will be left to supply wood in the future (40-year time period).

Presently the MoF is looking for young second-growth stands that are not quite ready to be harvested, but that could support a commercial thinning entry to sustain the flow of timber.

To date (August 15, 1994),[1] Forest Practices Branch had identified 4000 ha on the coast and 20,000 ha in the interior available for CT each year.

Flip chart: Summarize the following points.

Commercial thinning can:

- ▲ increase volume or value very modestly;
- ▲ benefit forests province-wide;
- ▲ deliver wood earlier; and
- ▲ alleviate some timber supply and IRM constraints.

This could help:

- ▲ keep mills operating;
- ▲ employ local people; and
- ▲ stabilize communities.

Care must be taken when using CT not to limit future options and opportunities – that is high grading the stand leaving uneconomic green illusions – reducing future options.

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[1] The section on growth and yield and timber flow is taken from: *Commercial Thinning. Executive Presentation*, Victoria, August 15, 1994. Prepared by Ken Mitchell, Jim Goudie, Mario Di Lucca, and Ken Polsson, FDPS, Research Branch.

Lesson 2

Commercial Thinning – Stand Selection Process

How to choose a suitable stand

75 minutes

Objectives:

1. To introduce the concept of appropriate and applicable stands for CT.
2. To outline the use of Reineke's Stand Density Index to help rank stands.
3. To use stock and stand data along with some simple grading rules to identify candidate stands.

Equipment Needs:

- flip chart
- overhead projector and screen

Method:

- lecturette
- short exercises
- slides (if available)

Note: Stands may be selected for a variety of reasons, one of which may be to harvest a stand where adjacency would not permit a clearcut. The assessments we will go over should help determine the suitability of the stand for CT.

CT – Stand selection

- Which stands are suitable?
- What information do I need and how should I collect it?
- Should I use a stand density method to identify my stand?

Overhead: Stand selection

This overhead introduces the subject

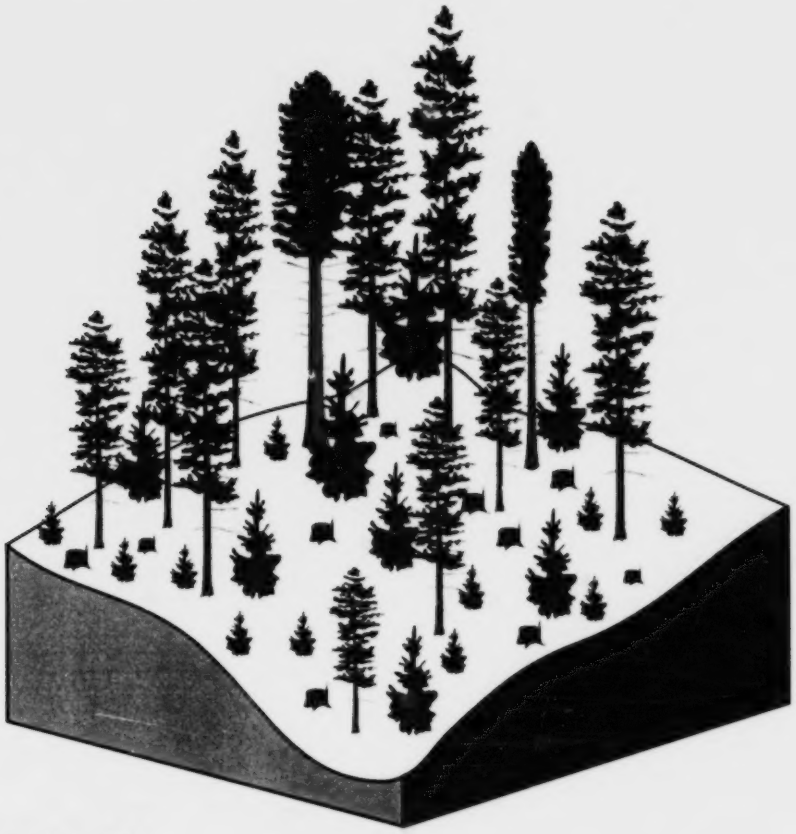
Facilitator:

This lesson is designed to go over the basic process of stand selection. This should be considered an overview. A field exercise could be used to provide greater familiarity with the tools described here.

1. What stands are suitable? – this is a big question and one that the second overhead covers in more detail.
2. What information do I need and how do I collect it? We will look at a reconnaissance card that was created to gather data relevant to partial cutting prescriptions.
3. In the guidebook (p. 7) numerous references of assessing stand density are provided. We have chosen one method to work through in this workshop— Reineke's Stand Density Index (SDI). The use of it or other methods is at the discretion of the prescriber.

Note: This overhead was designed as a lead-in – do not go into too much detail here. The overheads that follow are designed to provide more information.

CT – Candidate stands



Stands with:

- appropriate age, species and vigour
- adjacency requirements
- sensitive VQOs
- attributes that can improve wildlife habitat or biodiversity.

Overhead: **Stand selection – Candidate stands**

Facilitator: Use this overhead to spark discussion on which stands are suitable for CT.

The following have been listed on the overhead, but it is not a complete list. Add definition to those on the list and add others that seem appropriate.

- Stands of appropriate age – remember most of our harvests are still in old-growth stands that are past the usual rotation age (unless we are managing for old-growth characteristics). Therefore, most stands are beyond where CT is appropriate – as a regeneration cut should be used. This can vary if not windfirm…

  Appropriate means that they are merchantable but are not yet truly at rotation age, or are an old-growth stand that can survive and thrive to the next cut.

  The most appropriate species are those that can be logged at a profit and will not be unduly harmed by logging. The list of relative susceptibility to decay is found on page 25 of the guidebook. Hemlock and balsam species are most susceptible (after broadleaved species) and require great care if commercially thinned.

- Stands with adjacency requirements – The *Green-up Guidebook* describes maximum cutblock size. It states:

  These maximum block sizes apply to cutblocks that have a clearcut or seed tree silvicultural system where less than 40 per cent of the pre-harvest basal area has been retained on a portion of a block... (p. 5).

  Also – *Green-up requirements do not apply to: single tree selection and other uneven-aged management systems where at least 40 per cent of the pre-harvest basal area has been retained (p. 2).*

  Both of these guidelines would promote CT in areas with limitations on heavier removals.

- Stands within sensitive VQOs – in areas with low visual absorption capacity and in areas with retention or possibly partial retention VQOs, CT may be a temporary solution.

- Stands that can improve wildlife habitat or biodiversity – get input on this – CT could be used to create larger trees sooner, thus creating larger snags or wildlife trees sooner than untreated stands. Forage

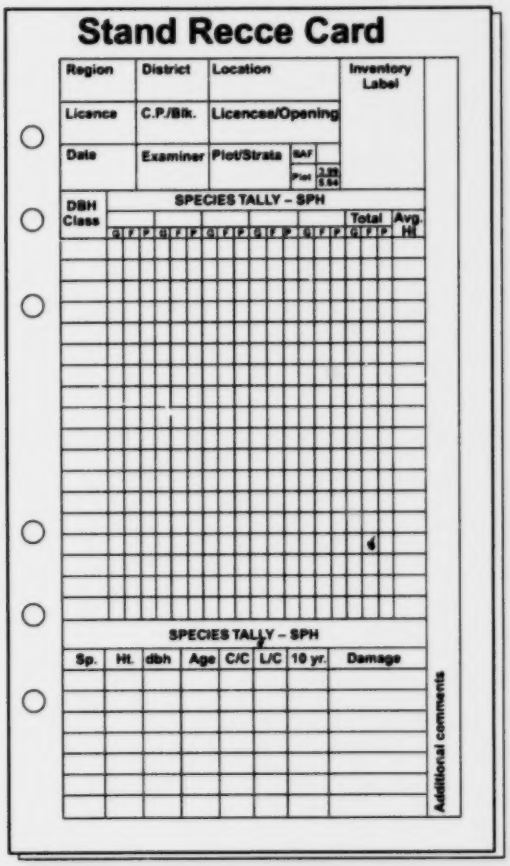
production increases should be minimal with CT, as site occupancy is usually a goal. If increased forage production is an objective, choosing a system that provides less crown cover may be preferable. In most cases, the old-growth attributes cannot be created in normal rotation lengths. Thus, it may be important to keep the trees that are being groomed for specific tasks past the removal cut of the silvicultural system.

Optional on the flip chart

Ask the group what stand characteristics and age are preferred – some examples (record on flip chart)

- Previously spaced
- Healthy trees with good crowns
- 40–60 years old – to provide merchantable volume now and provide enough time to rotation to add increment
- Douglas-fir on the coast, Pl in the interior.

CT – Stand selection



Recce to assess and provide:

- species and density
- release potential
- windthrow potential
- forest health
- harvesting feasibility
- approximate boundaries
- site index
- potential products.

Overhead: **Stand selection – Recce card**

Facilitator: Go over the need for good pre-harvest data

Question group: What different information would you want to collect for a partial cut vs. a clearcut?

The key is information on potential leave stems and on those you wish to harvest – you need to know how many and where the stems are to create a meaningful prescription.

Merchantability and logging costs are going to dictate whether you can commercially thin the block at a profit. Thus a breakdown by log size will be critical in estimating merchantability and the total number of stems can help to estimate whether there is an adequate number to break even.

Cruise information can be used – with additional information on vigour and windfirmness added in. Another method that is useful for prescription making is the Recce card.

Be sure the following points are covered:

- The form was created to help collect data relevant for partial cutting prescriptions.

Hold up the form and go over the important sections.

- The information required is the BAF of the prism used, the subplot size for tallying submerchantable stems. A description of the vigour criteria (back of the page).
- You can use the form for one plot or a number of plots. If you use it for numerous plots, be sure to record the number of plots in the plots/strata box.
- DBH classes can be the traditional 5 cm classes (e.g., 20 cm class is 17.5 – 22.5 cm). You may wish to choose larger classes – it is up to you. You may wish to organize it by log grade – such as breaking up the J grade into large gang (20–36 top diameter inside bark (dib), and small gang 20 cm top dib or under). To translate this into dbh, take into account taper and bark thickness. This will vary considerably by species and stand density.

These data are important as they can be used to place value on the stand and help choose cut/leave ratios. Learn as much about this as possible if you plan on using CT.

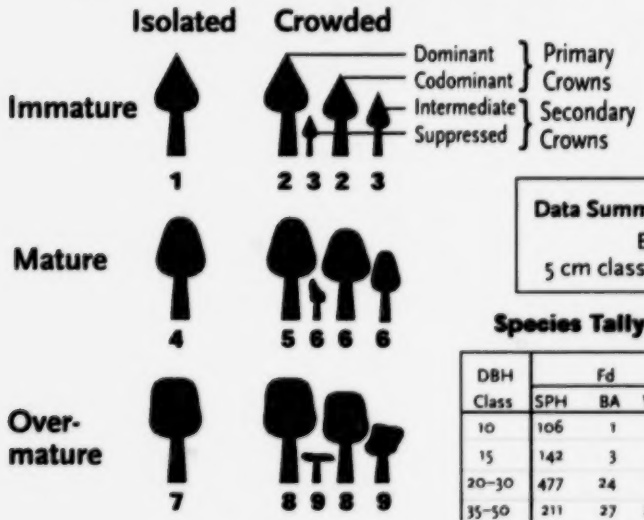
- Each species has three columns: G,F, and P. You must put the species name at the top and identify what constitutes G,F, and P on the back of the form. You may wish to use two codes – leave and take – but this may be difficult prior to seeing the whole stand.
- Sample tree information is presented at the bottom of the form. Obviously age and vigour are important considerations.
- On the back are spaces to assess windthrow hazard. This information is very important for the success of your prescription – be aware of windthrow hazards.
- Make notes on harvesting options – are there old trails that can be reused? Is it possible to use ground based systems?
- Figure out logical boundaries based on topography and windfirmness.
- Use the most accurate SI method – the height over age curves should work best in the age group you are in.
- Think about potential products while on site – how much will be pulp vs sawlog? Think about it.

Point out the other points on the OH.

- Block design may be significantly influenced by windthrow hazard.

CT – Stand selection

Almanor Tree Classification System



Data Summary Sheets by DBH Class Group
By SPH, BA and Volume
5 cm classes, 10 cm classes, other classes?

Species Tally by Diameter Class Group

DBH	Fd			Cw			Total		
Class	SPH	BA	VOL	SPH	BA	VOL	SPH	BA	VOL
10	106	1					106	1	
15	142	3		47	1		189	3	
20–30	477	24	151	134	7	42	611	31	193
35–50	211	27	235	39	6	55	249	33	290
55–70	36	11	119	7	2	18	43	12	137
75–100									
TOTAL	970	65	506	227	15	114	1197	80	620

Important Recce components are:

- **an assessment strategy (e.g., 30 plots or 1 plot per ha or × per strata...)**
- **clearly defined criteria for leave trees (see above)**
- **summary output tables, graphs (or both)**
- **data that can be used to create and justify your prescription.**

Overhead: **Stand selection – Recce – important components**

Facilitator: Important components of a recce[2]

- An assessment strategy – the block should be pre-stratified and a plan for assessment worked out. In some cases the block may be so heterogeneous that stratification is not practical – if so, sample the entire block as a mosaic.
- To get significant results in heterogeneous blocks, 30 plots are recommended. If the block is very homogeneous fewer plots may be needed to describe the stand adequately. There is no standard provided.
- Leave tree or vigour criteria are necessary to determine the feasibility of the harvest. This information can be summarized and an estimate of products created.
- A prism sweep is done for each plot – trees are put into diameter classes. You can measure each tree or estimate the diameter using a marked stick (metre stick or homemade version). You may have a specific cutoff point below which the trees are unmerchantable. Select the BAF (basal area factor of your prism) to get between 6–12 trees per plot.
- You may also wish to put in a fixed area plot and pick the leave and take trees from that plot. A 0.01 ha plot is 10×10 m and allows easy conversion to sph (stems times 100). For a circular plot of the same size the radius is 5.64 m.
- Remember the data you collect will be used to formulate and help you justify your prescription. Collect the important data while you are there – return a second time to corroborate your initial findings.

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[2] Note that this information is not for valuation purposes. Instead it is meant to provide adequate data from which to formulate a silviculture prescription.

CT – Stand selection

Reineke's stand density index

Reineke's is one of a number of methods.

- It assumes that site productivity is relatively constant over a range of densities.

$$SDI = N_O \times (D_q/25)^{1.605}$$

Dq = Quadratic mean diameter

$$Dq = \sqrt{\frac{\sum_{i=1}^{N} d_i^2}{N}}$$

Overhead: Stand Selection – Reineke's Stand Density Index

Facilitator: Go over the following:

Reineke's stand density index is one method to rank a stand for site occupancy.

- It is based on the concept that the number of stems for full site occupancy decreases as the stems grow. In other words, there is natural mortality of smaller stems leaving fewer larger stems over time.
- The equation uses the quadratic mean diameter from your stand and relates the number of trees in your stand to a density index of 25 cm stems.
- The outcome is then judged against a table of key values to determine where you are in terms of site occupancy.
- We have provided numbers for Fd and Hw. Alternative methods should be used for other species.

Key points:

- Explain how to calculate the quadratic mean diameter (Dq)

$$Dq = \sqrt{\frac{\sum_{i=1}^{N} d_i^2}{N}}$$

- Dq is the quadratic mean diameter (qmd)
- $\sum_{i=1}^{N} d_i^2$ is the sum of all the measured diameters (dbh) – **squared** (from a range of sample plots in the stratum)
- N = number of trees sampled to get the diameters – divide the sum of the squared diameters by N, then take the square root of the whole thing to get the Dq.
- Introduce the key value table for using the stand density index using the next overhead.

SDI = $N_0 \times (Dq/25)^{1.605}$

N_o = the number of stems per ha

Dq = qmd as calculated above.

The EXCEL formula is N_0*Power ((Dq/25), 1.605)

Note: We will have a short exercise using the table to promote greater comfort with the methodology.

CT – Stand selection

Levels of competition	% max. SDI	Species	
		Fd	Hw
Maximum	100	1450	1950
Lower limit of self thinning	60	870	1170
Lower limit of full site occupancy	35	510	680
Onset of competition	25	360	490

Key values for Reineke's stand density index

Overhead: Reineke's SDI – Table of key values

Facilitator:

This table provides values that were compiled by Long (1985) that relate to levels of site occupancy. The table is divided by species – go over one example, then have the participants turn to their neighbour for a ranking exercise based on 5 stands where they have been provided the qmd, stems per ha and SDI value for a local species.

The main points to emphasize from the table are:

The maximum level of competition (100% SDI) – After this point the stand is experiencing high levels of density-dependent mortality. At this point the stand is beyond traditional CT logic (timely harvest to capture mortality and provide added growth prior to final harvest). It may benefit from CT. However mortality has already claimed some volume and the remaining trees may have a prolonged adjustment period to provide additional growth due to reduced crown length.

The lower limit of self thinning (60% SDI) – After this point the stand begins to self thin itself through density-dependent mortality. You may find CT is effective at capturing mortality at this stage. However, if the stand is much beyond this point crown size will have been affected and response may be limited. The rule of thumb is to keep the stand below this point to maximize site potential.

Lower limit of full site occupancy (35% SDI) – This is the lower limit for which the site is fully occupied. An objective is to manage the stand to keep the density between this and 60% SDI, to maximize use of the resources on-site.

Onset of competition (25% SDI) – This often relates to crown closure. This is too soon to CT as growing space will be opened up prematurely for maximum volume production.

Workbook: Commercial thinning – SDI exercise

Facilitator:

Have the groups turn to their neighbour and go through the exercise of ranking these three stands as to their preference for commercial thinning. All blocks offer the same logistics (e.g., slope, aspect, roading). Have the groups provide justification for their ranking.

The data are as follows:

Douglas-fir SI = 30

Block 1 – SDI = 1277, N = 600 sph, QMD = 40 cm

Block 2 – SDI = 851, N = 400 sph, QMD = 40 cm

Block 3 – SDI = 848, N = 600 sph, QMD = 31 cm

Flip chart:

Go around the room and ask how the blocks were ranked – put the ranks on the flip chart. The fall-out based on the logic provided. Obviously if the sites offered different logistics or green-up considerations the ranking could differ.

Ranking – Block 2, (3, 1?)

1. Why block 2? It is near the 60% point and has a larger qmd than block 3 that has a similar SDI. It would therefore have fewer and larger stems to harvest (greater profit).
2. To be sure we would need more information at this point on the size of potential leave trees for block 3. Block 1 would cost more to harvest but would have more volume. It may have spindly (poor ht/diam ratio stems) and small crowns. Thus both 1 and 3 are questionable for CT without more info.

After ranking the stands, ask the group what further information they need to make a more accurate assessment. They should provide the following (as discussed for the Recce):

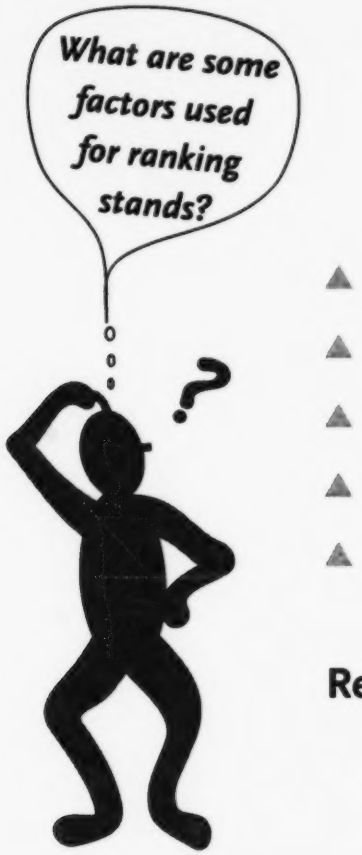
- ▲ diameter distribution
- ▲ species distribution – is it really all Fd
- ▲ crown lengths
- ▲ vigour
- ▲ basal area of the stand
- ▲ list others here as provided from your group

Important points to stress:

Remember density management tools must be used with a knowledge of the biology of the stand. Do not use the numbers without understanding possible limitations and assumptions.

Don't settle on one measure for picking your stand – use your head.

CT – Stand selection



Remember: Don't rely on only one measure. Use your head!

Overhead: **Commercial thinning – Other factors for ranking stands?**

Facilitator: Have the group read page 19 of the guidebook regarding other factors that can be used in selecting a stand for commercial thinning.

There is space on the overhead to add the additional factors:

- Size; age; level of competition; site quality; species (susceptibility to windthrow and decay); site sensitivity; access; piece size; volume per ha; need for fibre.

Question:

Are there any questions regarding the factors mentioned? Go over them if there are.

Is spacing a necessary condition for CT?

If so on what sites?

- medium sites, especially lodgepole pine

What are good candidate species?

- Coast – Douglas-fir, Cw, Bg, Hw?
- Interior – lodgepole pine, Fd, Lw, possibly spruce depends on windfirmness, Bl? Cw, Hw?

What makes for a good leave tree?

- lots of crown
- low height to diameter ratio (below 80 or 90)

How many trees are too many?

- depends upon the merchantability and logging costs. If the stems are merchantable production rates usually increase with more stems being taken (up to a point).

Lesson 3

Commercial Thinning – Economics

What do we need to know?

60 minutes

Objectives:

1. To pick stands that are economically suited for CT.
2. To introduce some common economic terms and explain what they mean.
3. To make prescription writers aware of the value differences by log size.
4. To review current information on the profitability of CT.

Equipment Needs:

- ▲ flip chart
- ▲ overhead projector

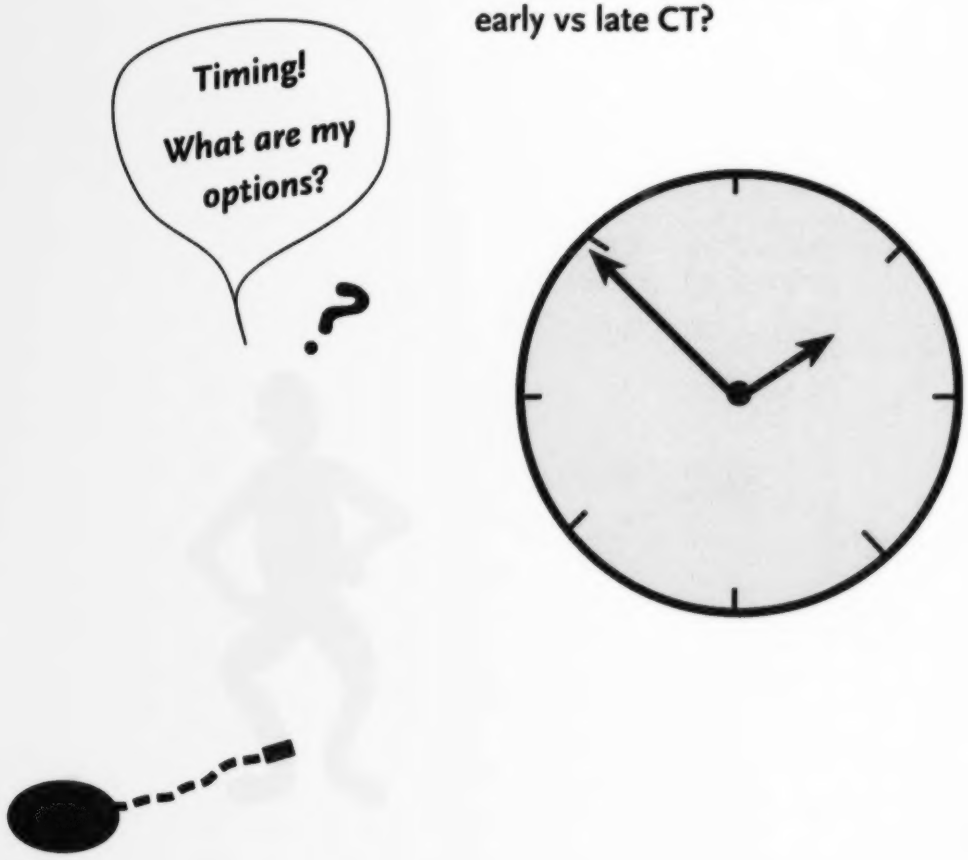
Method:

- ▲ lecturette

CT – It should pay

Timing of thinning

- When is best?
- What are the impacts of early vs late CT?



Overhead: Commercial thinning – It should pay

Facilitator: When to commercial thin – what are the options?

In most cases, when the CT is going to be done to obtain volume where adjacency considerations limit harvesting, the timing will be dictated for you – or you will have your hands tied.

When it is being planned and implemented without spatial constraints, there are some economic considerations.

▲ **If you harvest too early the value of the crop will be lower than if you wait for larger piece sizes.**

Stone's profit and NPV tables show the trade-offs for harvesting early or later. Remember, if you wait until the stand is more merchantable, it will push your rotation age out, especially if the CT was done to a relatively low density.

Thus timing must be based on rotation length, site potential (site index – as better sites respond faster), and markets for the thinned material. As a rule of thumb, CT is viable on a range of sites from age 30 (very good sites) to age 70 and beyond. The time between CT and final harvest will depend upon the CT intensity, but ranges from 10 (very light thinning) to 40 years for heavier thinning.

▲ **The effect of waiting too long is that it will prolong the final rotation date, and that you may miss some natural mortality.**

Commercial Thinning – Economics Age vs Size

- The age of the stand is not as important as the size of the stems and their merchantability.
- For CT (like all harvesting) the intent is to make money.

CT cuts smaller logs making timber grades especially important.

Overhead: **Commercial Thinning – Economics**
– Age vs size

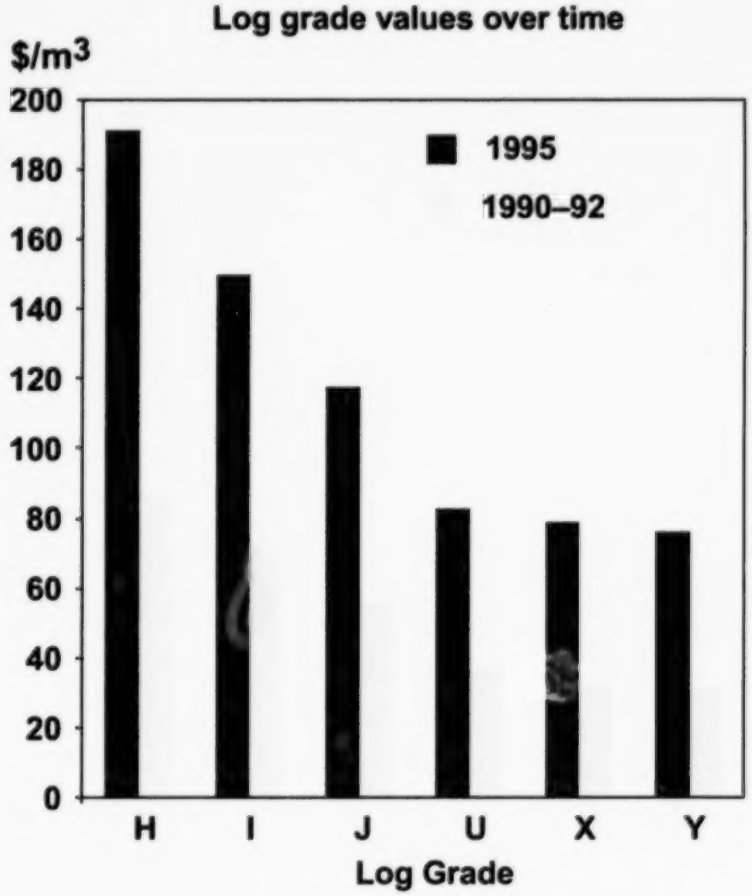
Facilitator: When to commercial thin – what are the options?

This is an introductory overhead that introduces the issue of economics.

The section will contain an overview of value by log grade or piece size, NPV vs SV, generalizations from NPV runs, a look at the review of the economics of CT in BC.

Commercial Thinning – Size and Value

1990–92 and 1995 Average Log Prices by Grade



Overhead: **Commercial Thinning – Economics – Size and Value**

Facilitator: Use this overhead to show the value of larger piece sizes.

Stress the following:

Commercial thinning will not likely add much volume to the stand but can create conditions where additional growth of leave trees makes them more valuable.

Log grades are based on log length, top diameter, size of knots, number of rings per rad (2 cm section), amount of merchantable wood per log and species. Information on log grades can be obtained from the MoF Revenue Branch *Scaling Manual*.

The values by log grade (1990–1992) are from Stone (1993), page 80. They are in 1992 dollars. The 1995 data are from *Forestry Industry Trader.* Monthly figures from the Vancouver log market and are in 1995 dollars. There are two obvious trends.

1. As you move from H through to Y grade logs the value decreases significantly.

2. The trend is similar for both reporting periods.

Ask: What factors are used in grading logs?

CT – Size and Value

Log Grading Rules – Coastal BC

Grade	Minimum length	Minimum top diameter	Maximum knot size
D	5.0	76	n/a
F	5.0	60	n/a
H	5.0	38	5
I	3.8	38	8
J	5.0	16	4
U	5.0	10	4
X	3.0	10	4
Y	n/a	10	n/a

- Think of the log grades your stand will produce over time.
- Use growth models to help you estimate log size.
- Log length, top diameter and knot size influence grade.

Overhead: **Commercial thinning – Log grading rules**

Facilitator: Walk the group through the listed log grades pointing out the important variables (i.e., minimum top diameter inside bark [dib], knot size and length of log).

Log grades for coastal B.C. logs are defined in the Ministry of Forests (Revenue Branch) *Scaling Manual*. Value (1995) *Forest Industry Trader – Vancouver Log Market Monthly* averages, and 1990–1992 from Stone (1993).

D grade sawlog – minimum top dib is 76 cm; minimum 90% of the surface is clear; minimum length is 5 m; minimum of 3 rings/cm in the outer third of the log; minimum of 75% merchantable; 50% clear. This is an 'old-growth' grade.

1995 average price = $617.41/m^3

F grade sawlog – minimum top dib is 60 cm; maximum knot size 4 cm; minimum 75% of the surface is clear; minimum length is 5 m; minimum of 3 rings/cm in the outer third of the log; minimum of 75% merchantable; 25% clear.

1995 average price = $381.15/m^3

H grade sawlog – minimum top dib = 38 cm, maximum knot size is 4–8 cm; minimum length of the log is 5 m; minimum of 2.5 rings/cm in the outer third of the log; 50–75% lumber, 65% merchantable.

1995 average price = $191.34/m^3 (1992 – $87.28)

I grade – minimum top dib 38 cm; maximum knot size 8–10 cm; minimum length is 3.8 m; 50–75% lumber, 65% merchantable.

1995 average price = $149.39/m^3 (1992 – $70.55)

J grade (gang) – minimum top dib 16 cm; maximum knot size 6 cm; minimum length is 5 m; 75% lumber, 50% merchantable.

1995 average price = $117.30/m^3 (1992 – $55.65)

U grade – minimum top dib = 10 cm; minimum length; maximum knot size 4–14 cm; 50–75% lumber, 35% merchantable.

1995 average price = $82.32/m^3 (1992 – $36.42)

X grade – utility grade – minimum top dib = 10 cm; minimum length; maximum knot size 4–14 cm; 33.3%+ lumber, 35% merchantable.

1995 average selling price = $78.69/m3

Y grade – Chipper grade – < utility > firmwood reject

1995 average selling price = $75.82/m^3

Commercial Thinning – Economics

NPV vs SV?

What are we talking about?

- bringing costs and revenues to one point in time
- using a discount rate to account for time

$$SV = \frac{\sum_{i=0}^{A} R_i (1+r)^{A-i} - \sum_{i=0}^{A} C_i (1+r)^{A-i}}{(1+r)^{A} - 1}$$

R_i = revenue at age i

C_i = cost incurred at age i

r = the discount rate

A = the rotation age

Overhead: **Commercial Thinning – NPV vs SV**

Facilitator: SV vs NPV.

SV – is also known as soil rent, bare land value, and soil expectation value. SV works the same as net present value (NPV), except it starts the block from bare ground and includes all costs from there on. That includes regeneration, spacing, etc. The NPV calculations deal only with current and future costs; old costs are considered sunk. For a good overview and lots more equations see Stone (1993), page 22–23.

Note: NPV can only be estimated, as we do not know the future timber values or harvesting costs.

First of all what is NPV and why do we do we use it?

Facilitator must become familiar with this information.

- NPV is the net present value. It is used to compare value over time using the notion of interest adding to value over time. The concept is that if we sold something today we could invest the money and that sum would be greater in the future due to compound interest. The interest rate chosen by Stone (1993, 1995) is 4%. This is often called the social discount rate, or the rate at which society deems an investment worthwhile. This 4% is after inflation.
- Do we have to go through the calculations for each block we treat?
- No. Stone (1993, 1995) provides example tables for numerous scenarios that should be used when you have a similar site. If you are planning a significant CT operation it may be worthwhile to work through a more specific analysis. The Forest Practices Branch is preparing a two-day workshop that would help in your financial assessment. We will only touch on the inputs here.
- The formulas seen on this overhead are found in Stone (1993), pages 21–23. If you have information to fill in the cost and projected revenue figures, you can use the formulas found there to determine NPV for your regime.

Commercial Thinning – Economics

Some generalities from NPV runs:

Fdc

- **SI 36 – thinning to 200–400 is economically better than unthinned for all densities tested**
- **SI 30:**
  - **200–300 leave best at mid-thinning age for no PCT**
  - **200 sph leave was best for the late thinning age with no PCT**
  - **with PCT, all thining densities had higher NPV vs unthinned**
- **SI 24 – marginal effects**

Overhead: **Some generalities from NPV runs for Fdc**

Facilitator: Go over the generalities; more detail is found on page 128 in Stone (1993). The marginal effects found with SI 24 indicates the initial cut opens up the stand and leaves it unproductive for too long to make the two pass system economic. Open space is not putting on volume and the remaining trees are not putting on enough to add enough to their value to make it worthwhile.

NPV calculations favor taking lots and leaving fewer to get big quick. Where it isn't productive, this doesn't happen.

Key Points:

The why behind the higher NPVs:

- thinnings concentrate growth on fewer, bigger trees, which create higher value wood
- thinnings produce interim revenues – liquidation of lousy stocks
- sell low/buy high – or did I get that wrong? Cut the poorer part of the portfolio to add room for the better stock to grow.

Commercial Thinning – Economics

Some generalities from NPV runs:

Pli

- **NPV is generally higher for non-thinned simulations**
- **Rotation age is the key**
  - **with longer rotations (past the economic max), lighter thinnings give the best results when harvests are planned in less than 90–100 years**
  - **heavier thinnings give higher returns when harvests are planned for more than 100 years**
  - **for guidance, see table 6.1, page 101 in Stone (1996)**

Overhead: **Some generalities from NPV runs**

Facilitator: Go over the generalities – more detail is found on page 81 and continued on 102 in Stone (1996).

Ask: Why do you think the lighter thinnings give better results with shorter rotation lengths?

Light thinnings are better than heavy with shorter end rotation lengths because there is more time for trees to grow and put on value the longer you wait. You will get fewer, bigger trees that are worth more. With the shorter rotation length and the relatively slow growth, there is not enough additional growth per tree.

Key Points:

The why behind the higher NPVs:

- ▲ thinnings concentrate growth on fewer, bigger trees, which create higher value wood
- ▲ thinnings produce interim revenues – liquidation of lousy stocks
- ▲ sell low/buy high – or did I get that wrong? Cut the poorer part of the portfolio to add room for the better stock to grow.

For a discussion on how Stone presents his results:

There are two overheads, one of SI 22 and one of SI 16, both to 100 years with increments of 10 beginning at 50.

Use the overheads to go over how they work.

Site Index 22

Harvest Age	2,500	5,000	10,000	PCT 1,600	PCT 1,200	PCT 800
50	CC	CC	CC	CC	CC	CC
60	CC	40–900	40–900	CC	CC	CC
70	CC	40–900	40–900	CC	CC	CC
80	50–600	40–900	40–900	50–600	50–600	50–600
90	50–600	40–900	40–900	50–600	50–600	50–600
100	50–600	50–600	50–600	50–600	50–600	50–600

Site Index 16

Harvest Age	2,500	5,000	10,000	PCT 1,600	PCT 1,200	PCT 800
50	CC	CC	CC	CC	CC	n.a.
60	CC	CC	CC	CC	CC	n.a.
70	CC	60–900	60–900	CC	CC	n.a.
80	CC	60–900	60–900	CC	CC	n.a.
90	60–600	60–600	60–900	70–600	CC	n.a.
100	60–600	60–600	60–900	70–600	70–600	n.a.

For the facilitator guide

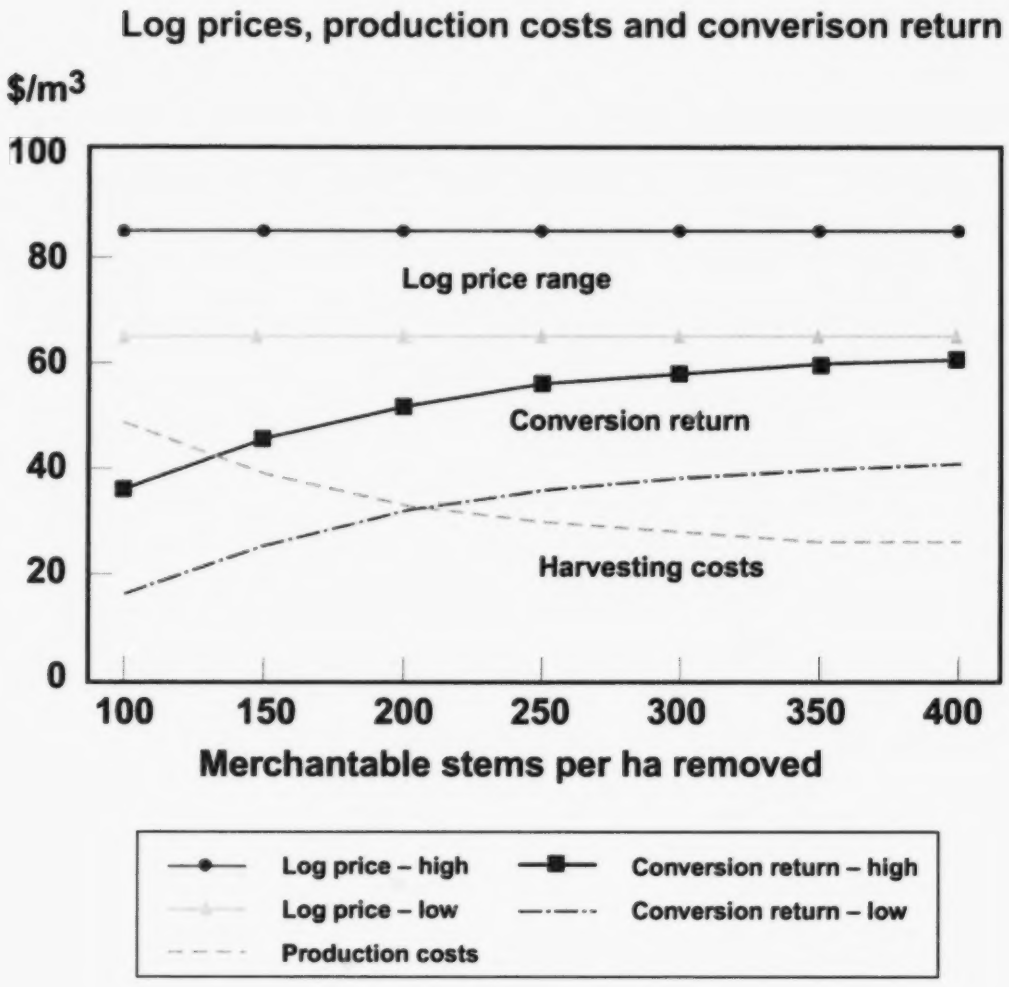
Economics exercise: ***Small groups. Each group is to come up with three important considerations for a profitable commercial thinning operation.***
They will be guided to read section 7.0 of the Simons Reid Collins Report.

Time: 15 minutes to research; 20 minute discussion

Some expected answers:

- markets must be relatively high to get a positive return for smaller logs.
- the number and size of the logs removed is important. Depending upon the value, the minimum number may be in the order of 200+ stems/ha.
- the operating costs need to be kept low by using appropriate equipment
- the more stems you remove the better the profit margin looks
- the stand must be old enough to have merchantable stems
- lower site index sites will be older than better sites to provide the same volume
- thinnings may need to come from a range of diameter classes not just from below, to provide an economic return
- piece size is important: as the average piece size drops, more stems are needed to break even.

Fir – Gang Sort



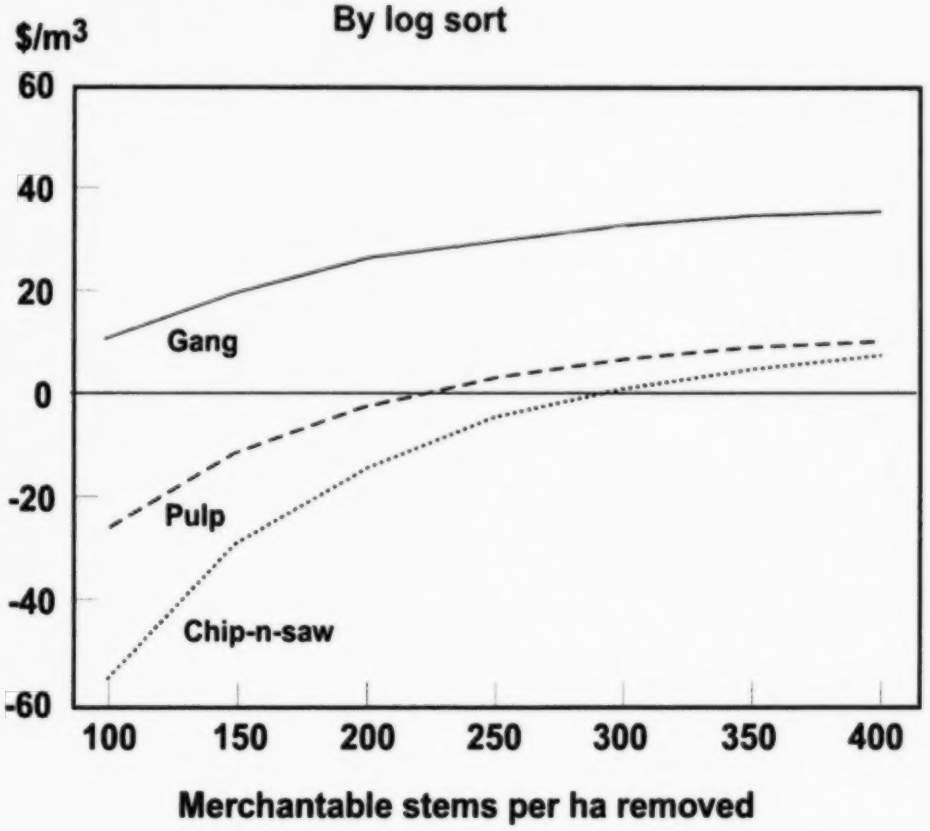
For the workbook include:

Economics exercise: ***Small groups. Come up with three or more important considerations for a profitable commercial thinning operation.***
See section 7.0 of the Simons Reid Collins Report in the back of your binder.

Time: 15 minutes to research; 20 minute discussion

Use overheads 3•10 and 3•11 as backup material.

Average Species Conversion Return



Gang is mostly large J with minor amounts of H, I and U.

Chip-n-saw is mainly U with minor amouns of small J and X.

Pulp is primarily U and X with minor amounts of Y.

Small J is a chip-n-saw log with top 20 cm dib or smaller.

Large J is a gang log 20–36 cm top dib.

Lesson 4

Project Administration and Monitoring

– an overview of the necessary steps and the intent

20 minutes

Objectives:

1. The participants will be aware of the flow and intent of operational planning and contractual documents for commercial thinning projects.
2. The participants will be aware of the necessary fieldwork steps for data collection and layout and the timing and intent of each step.
3. The participants will discuss the choice of marking approaches and some issues associated with marking for commercial thinning.
4. The participants will be aware of the various approaches to collecting data for thinning quality (post treatment plots). The appropriateness of the various approaches under various situations will be discussed.

Equipment Needs:

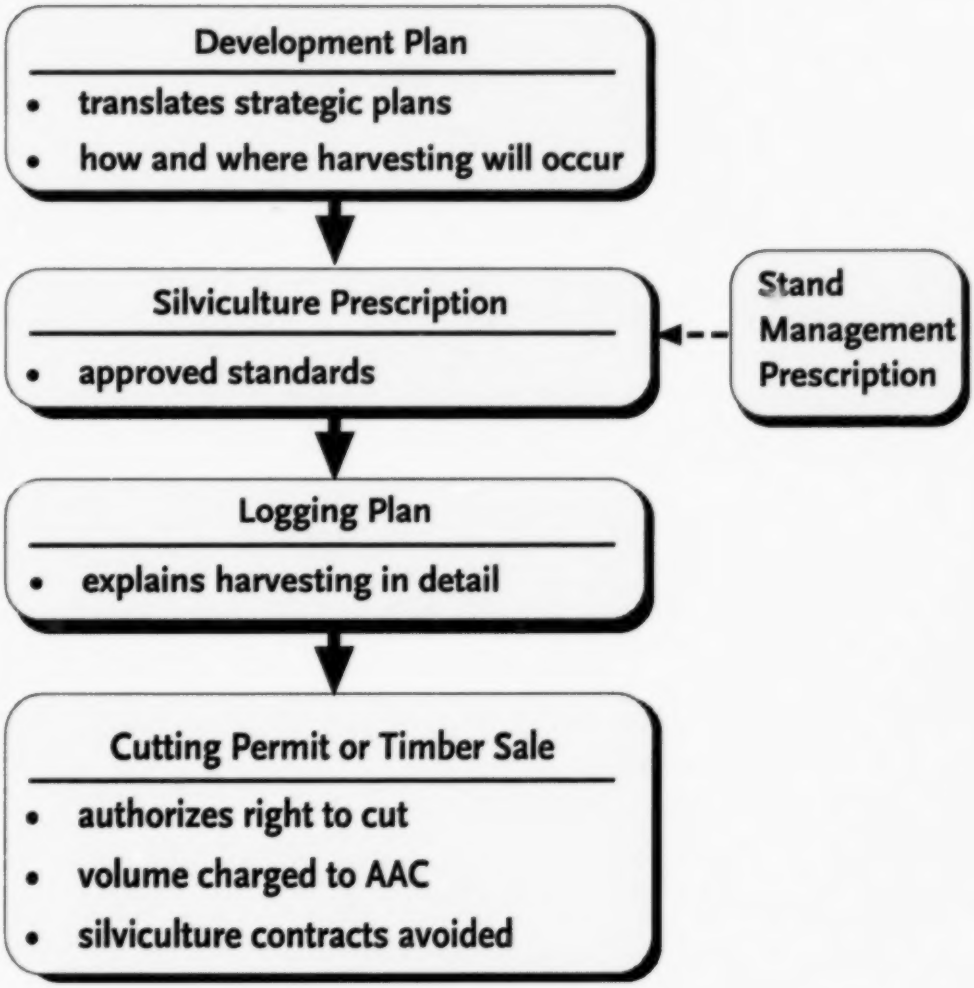
- overhead projector
- flip chart
- *Commercial Thinning Guidebook*

Method:

- lecturette with discussion

Operational Planning and Commercial Thinning

Higher level plans provide guidance



Overhead: **Operational Planning and Commercial Thinning**

Facilitator: Review the overhead – reinforce the importance and fit of each administrative step with the other. Be sure to emphasize that higher level plans should provide guidance for the operational plans.

Note: While this information is important it does not differ from normal procedures (i.e., harvesting other than CT). Therefore it can be skimmed over or left out if time is limiting.

Key Points:

The Development Plan

- The development plan guides the planning process over the next five-year period. It translates higher level strategic plans (objectives and strategies) for resource management areas or zones of emphasis where various resource objectives have been ranked in an LRMP (TSA level) or management plan (TFL).
- Where landscape unit plans have been developed on a drainage-by-drainage basis, development plans will incorporate all of the detailed strategic planning for FENs, old-growth reserves, riparian areas, and other special areas, as well as the objectives and strategies for various resource management zones.
- The development plan will demonstrate where and how harvesting activities will occur over the next five-year period, including all planned commercial thinning blocks.

The SMP and SP

- The SMP (if one was developed) may include a strategy for commercial thinning at the stand level, together with all other incremental activities. These plans are developed well before commercial thinning (usually at the time of spacing) so that they will eventually feed into the SP required for the commercial thinning harvest. This progression will not be apparent for some time.
- An SP approved by the DM is required prior to harvesting under a cutting permit in a commercial thinning block (or any cutblock).

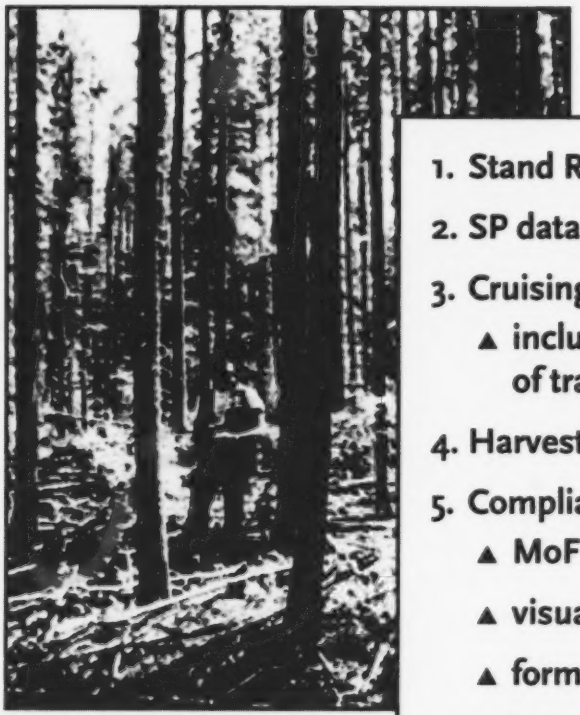
The Logging Plan

- The logging plan (approved by the DM) is also required prior to harvesting under a cutting permit.
- The logging plan is required under the *Act* to be consistent with the development plan and the SP. The *Act* takes the logging plan beyond a contractual agreement (as it used to be) and makes it a legal requirement, with administrative penalties attached for non-compliance with key content requirements.
- The logging plan differs from the SP in that it adds details to the direction for harvesting in an approved development plan and SP. It describes how harvesting will actually be carried out in explicit detail at a cutblock-by-cutblock level. All harvesting actions required to meet the SP requirements are detailed.

The Cutting Permit or Timber Sale Licence

- The cutting permit or timber sale authorizes the right to harvest timber within a specified time period. The cutting permit is the document that is used for woodlot licences and major licences.
- All wood harvested under the approved utilization standards will be charged to the AAC of the licensee.
- Note: The MoF policy is to use standard CPs and TSLs to authorize commercial thinning. SBFEP blocks should be logged under a competitively awarded TSL. Silviculture contracts should be avoided. There are, however, some exceptions.
  - ~ **Ask the participants from the MoF for the exceptions.**
  - ~ If no applications for the advertised timber sale are received and the DM determines that non-economic reasons justify the continuation of the project (e.g., forest health).
  - ~ The DM in such a case will enter into a silviculture contract, but will generally retain the ownership of the decked logs to be sold competitively. There may be exceptions to this as well – *read the project administration section of the* Commercial Thinning Guidebook *for more information.*
- The suitability of the operator's equipment should be made available during the tendering phase for SBFEP timber sales. It is critical that the timber sale is awarded to the contractor with the right equipment to meet requirements in the logging plan and SP.

Fieldwork



1. Stand Recce
2. SP data collection
3. Cruising and layout
   - ▲ include marking, prelocation of trails and reserves
4. Harvest monitoring
5. Compliance inspections
   - ▲ MoF enforcement officers
   - ▲ visual, with some plots
   - ▲ formal assessment if needed
6. Post-thinning plots
   - ▲ contract payment
   - ▲ reporting
7. Free growing assessment
   - ▲ 2+ years later

Overhead: **Fieldwork**

Facilitator: Review the requirements for fieldwork at the various critical stages for data collection, layout and monitoring.

Key Points:

The Stand Recce

- Initial stand-level data collection may occur even before the SP data collection – at the stand recce stage. Information from the stand recce may feed into development planning, SP development and the logging plan.

The SP

- The SP data are used to help determine and justify standards, harvesting methods and other future treatments.
- As previously mentioned the SP should include stand and stock tables and a windthrow hazard assessment for all soil types, timber types and changes in wind exposure.

Cruising and Layout

- The layout of the harvesting block should occur before the submission of the logging plan.
- This will include marking of timber (if required), prelocation of trails and demarcation of any reserves, special areas, and no-work zones.

Harvest Monitoring (MoF or Industry Technician)

- Should be every day during start-up and as required to facilitate meeting the requirements of the SP and logging plan.

Compliance Inspections

- May occur throughout the harvesting operation and as a minimum will occur afterwards.
- Generally these will initially include a visual inspection followed by formal compliance surveys if deemed necessary. More on this later with regards to soil conservation and stand damage.

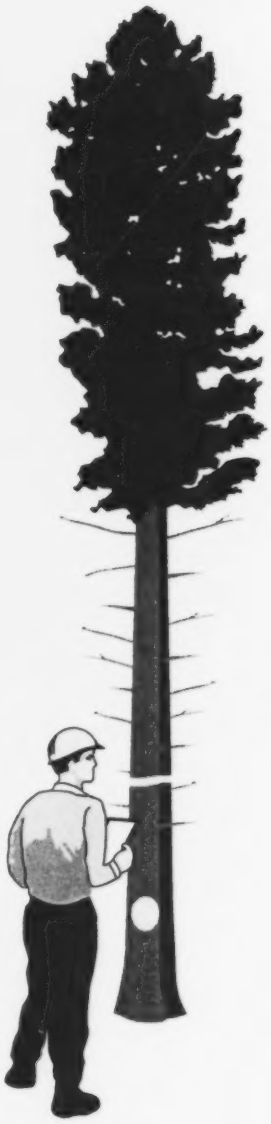
Post-thinning Plots

- Post-treatment plots will be used to:
  - determine the success of the operation for the contractor and potential penalties for contractual non-compliance.
  - report on the post-harvesting stand structure, density and composition.

Free Growing Assessment

- Several years after the thinning operation, another walk-through will be required to determine if the licensee can be relieved of responsibilities for a free growing stand. Basically this will entail just a check to make sure no added windthrow or other damaging agent has created a significant NSR situation.
- Timing for this walk-through will vary depending on the stand and its associated windthrow hazard, insect and disease hazard etc., but generally this will be 2–5 years after thinning.
- If the stand appears to have little added damage, the thinning quality assessment will be accepted as the free growing survey.
- If doubts are raised about the reliability of the thinning quality assessment, due to subsequent timber losses, another survey may be initiated.

Marking approaches



1. Fallers choice
2. Mark-to-leave
3. Mark-to-cut

Consider advantages and limitations of each.

- Build in flexibility for faller substitution
- Assessment of marking quality is a must before falling begins.

Overhead: **Marking Approaches**

Facilitator: Review the appropriate application of the three approaches and the advantages and disadvantages of each. Cost may be a factor – a possible option is to mark a portion of the block to train the fallers, and have the faller select on the remainder. More supervision may be required with this approach.

Key Points:

Faller's Choice (no marking)

- When leave-tree selection is less important to the achievement of objectives and results can mainly be assessed by residual density and/or basal area.
  - use in very uniform stands where decisions are very straightforward
  - use where stand structural decisions and goals are very simple
  - some types of harvesting equipment can only work this way (i.e., single-grip harvesters do not work well in marked stands).
- Some other questions you should ask yourself before contemplating this method:
  - Do the fallers understand and care enough about your objectives to make the right choices?
  - Do the markers, or potential markers, know enough about falling in a stand like this to recognize safety or logistical falling problems?
  - Many classic European foresters do not agree with allowing the logger to make your most critical stand structural decisions. They see it as their role.
  - Do we have the resources to properly monitor and supervise the fallers?
  - With the right people doing the falling, well-trained, with your objectives as a priority, this method has been made to work.

Mark-to-leave

- The classical European method to approach partial cutting.
- Best when more basal area will be cut than is left.
- **Advantage:** Forces the marker to focus on the leave trees for decisions.

- Easier to preplan the stand for roads and trails.
- Removes uncertainty with SBFEP sales (as does mark-to-cut).
- It defines what looks good, which is often used as a rule of thumb. If it looks good it likely is good (some truth to this).

Mark-to-cut

- Best when less basal area is cut than is left.
- **Advantage:** Quick – cut stems are often easy to choose (small, poor form, defective).
- **Limitations:** Tough for marker to visualize the residual stand. But again, with trained markers it has worked well in all sorts of stand structures and harvesting regimes.
- An advantage for aesthetics is that all marked trees are harvested. Therefore there are no unsightly paint marks on the leave trees – this may be important in high visibility areas. The opposite may be true for demonstration areas where you wish to show that the block was commercially thinned and specific trees were left (i.e., marked).

Substitutions for marked trees

Flexibility must be built into logging plans, contracts and cutting permits to allow fallers to substitute similar leave trees close by when a marked tree presents an unacceptable falling situation.

Lots of latitude should be allowed in previously unmanaged stands, while less latitude may be included in managed stands that are more open and uniform. In all marking situations some latitude must be allowed. Often this may be determined by working with input from the contractor at the pre-marking stage.

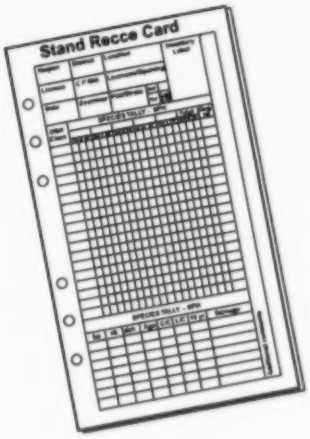
Assessing marking quality

Remember: Marking is the critical stage in determining the residual stand characteristics.

Many managers will favour no marking to avoid this extra step in the fieldwork and will therefore have to place responsibilities and possible contractual obligations on the logging contractor to ensure compliance with SP standards.

Some managers will see marking as an opportunity for a "first stab" at creating the structure described in the SP. If the marking is inadequate, changes can still be made.

Post-thinning plots



Data to collect:

- stems/ha (by species and dbh class)
- damaged stems/ha
- sample tree data

Diameter = 11.28 m

Methods of data collection

Intensity depends on variability:

1. Fixed radius plots
   - min. 6 trees/plot
   - min. 5 plots/SU
2. Prism plots
   - a BAF to get 6 trees/plot
3. Strip cruise
   - a total cruise in uniformly spaced strips

Overhead: **Post-thinning plots**

Facilitator: Review the basic procedure

Key Points:

The following data should be collected:

- The number of trees in the plot (or "IN Trees" for the prism) by diameter classes, by species. Stems may be further broken into vigour classes, however these must be well defined.
- Sample tree data – heights, exact diameters, % live crown and any other noted conditions for sample trees of all species in all diameter classes.
- All damaged stems should be categorized by amount and type of damage according to the standards. If these plots are to be relied on for assessment of damage, more plots may have to be established to get a reliable estimate.

Methods of Data Collection:

- There are 3 choices of data collection methodologies for collection of information regarding post-treatment stand structure and thinning quality:

1. Fixed radius plots
   - of sufficient size to achieve a minimum of 6 trees per plot.
   - minimum of 5 well distributed plots per stratum or standards unit (SU), however more plots are recommended in variable stands until an adequate comfort level with the data is achieved.
2. Prism plots
   - use a BAF to achieve a minimum of 6 trees per plot.
   - minimum of 5 well distributed plots per stratum or standards unit (SU), however more plots are recommended in variable stands until an adequate comfort level with the data is achieved.
   - often 10–20 plots can be done relatively quickly with the prism method.
3. Strip cruise
   - total cruise of trees within uniformly spaced strips of variable width, based on the desired sampling intensity and the size of the area. See the *Commercial Thinning Guidebook* for more information.
   - Sampling intensity will depend on the variability of the unit.
   - This method is borrowed from the Newfoundland Forest Service.

Lesson 5 Compliance Issues

Ensuring commercial thinning complies with the Forest Practices Code

90 minutes

Objectives:

1. Participants will be aware of the major compliance issues specific to commercial thinning and partial cutting.
2. Participants will be aware of the compliance assessment procedures, the associated standards, and the potential penalties for non-compliance.
3. Participants will discuss approaches to ensure compliance for the major commercial thinning issues.

Equipment Needs:

- ▲ overhead projector
- ▲ flip chart
- ▲ associated references

Method:

Several large and small group discussions will explore the key compliance issues that are specific to commercial thinning. Several case studies will be used to provide some depth for these discussions. Small lecturettes will help to round out the discussions with background and further information on compliance assessment procedures and related issues.

The participants and the facilitator will together brainstorm ideas to ensure compliance for the major issues noted.

Compliance inspections

- MoF enforcement officers
- Post-harvest as a minimum

Criteria (SP and logging plan):

- seasonal constraints
- logging methods
- utilization standards
- opening size/configuration
- protected/reserve area commitments
- deactivation/rehabilitation
- limits for soil conservation
- leave tree characteristics and stand damage
- other special commitments

Overhead: Criteria for compliance inspections

Facilitator:

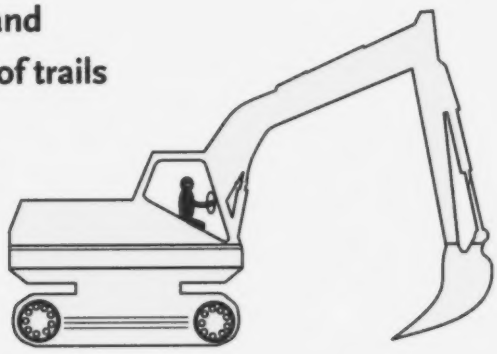
Key Points:

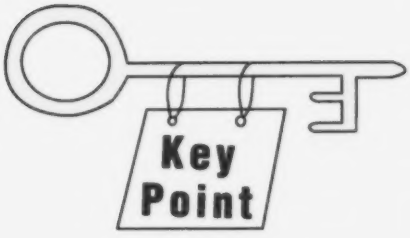
- Compliance inspections will be done by enforcement officers with the Ministry of Forests.
- These inspections may be done concurrently with harvesting, but as a minimum, harvesting will be inspected upon completion.
- The inspector will be looking for compliance with the SP (and the associated logging plan) based on the following criteria:
  - seasonal constraints
  - permissible logging methods
  - utilization standards
  - opening size/configuration
  - protected/reserved areas (including riparian zones)
  - **deactivation/rehabilitation activities**
  - **limits for soil disturbance**
  - **leave tree characteristics and stand damage protection**
  - other special commitments

  While many of these criteria are no different than for other harvesting operations, there are some special considerations for the three highlighted criteria. For this reason we will expand on these issues, discussing how they will be assessed, relevant regulations, ministry policy and interpretations, and measures you can take to avoid non-compliance situations.

Commercial thinning: Soil conservation compliance issues

1. **Deactivation and rehabilitation of trails**





Potential Soil Disturbance Categories in the SP:

Overhead: **Thinning/Soil conservation compliance issues**

1. ***Deactivation and rehabilitation of logging trails in the stand.***

Facilitator: Ask the participants how this should be handled for commercial thinning? What is the key point to remember?

Key Point:

- No rehabilitation of skidding trails or yarding corridors within the stand should occur in commercial thinning areas.
  - Excavated or bladed trails **should be avoided** as much as possible.
  - Unbladed logging trails (and corridors) within the stand **should not** be designated as temporary access, which is required to be rehabbed after logging.
  - Why? – damage to roots may occur as soil is decompacted while being rehabilitated.
  - The trails may be deactivated by waterbarring and grass-seeding where erosion concerns exist (usually on a slope).

Ask: What does this mean when you develop your SP and associated logging plan? How do you designate these trails for soil disturbance?

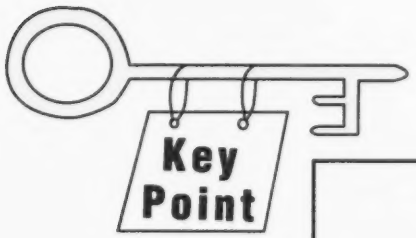
- These trails and corridors must be designated and dealt with under either of the following categories:
  - permanent access, or
  - dispersed disturbance in the net area to be reforested (NAR)

Note:

- On areas with a moderate to high likelihood of landslides, excavated or bladed trails will only be allowed if a geotech. (or similarly qualified person) has determined that the trails will not contribute to unstable terrain.
- On areas within community watersheds with a high or very high soil erosion hazard, or a moderate to high risk of sediment delivery in streams, excavated or bladed trails will not be allowed.

Commercial thinning: Soil conservation compliance issues

2. **Closely-timed harvesting events**



Overhead: **Thinning/Soil conservation compliance issues**

2. *Closely timed harvesting events (15–50 years)*

Facilitator: Ask the participants how this should be handled for commercial thinning?
What is the key point to remember?

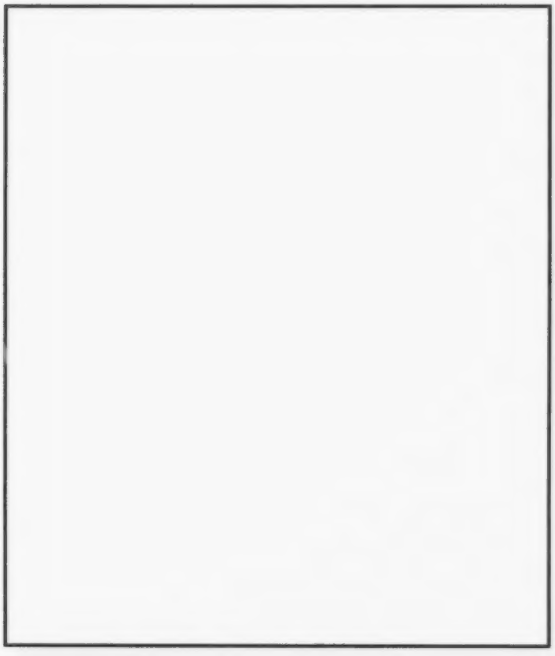
Key Point:

- ▲ Disturbance from repeated harvesting events should be concentrated on the same trail/corridor network as much as possible.
- ▲ Trails with a potential to be re-used must be mapped on the logging plan, so they can be tracked through time.

Commercial thinning: Soil conservation compliance issues

3. **Cosely-spaced unbladed logging trails**

Case study #1



Overhead: **Thinning/Soil conservation compliance issues**

3. Closely-spaced, unbladed logging trails

Facilitator: **Turn to your neighbour exercise** – Allow the participants time to read the case study and discuss the attached question.

15 minutes

- Tell them that we are going to explore this issue through several case studies.

Flip chart: Debrief the case study being sure to touch on the key points below, placing key points on the flip chart.

Key Points:

Question #1:

- In this scenario the intent will be continuous use of the trails on an uneven-aged basis with no intent to ever regenerate the area they occupy. Therefore, it would not make sense to call them anything other than permanent access.
- The *Soil Conservation Guidebook* supports this designation. Show them overhead 6.5.

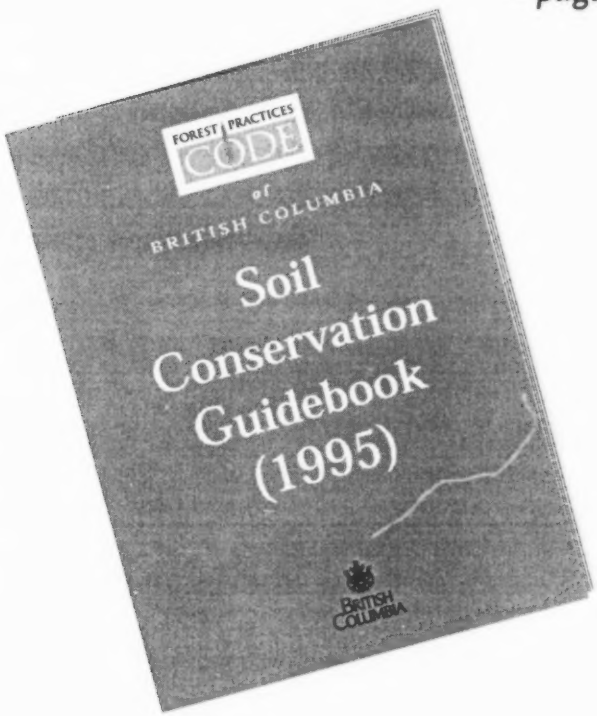
Question #2:

- Since countable soil disturbance on the trail network is only at 2.0%, it would make more sense to include the trails in the dispersed NAR disturbance.
- A formal compliance survey would yield 2.5% permanent access and 2% dispersed NAR disturbance — well within the allowable limits.
- It is critical in this situation that these unbladed trails still be mapped in the logging plan so that they can be found and used in the next entry (on the coast understory vegetation can obscure these trails within 5–10 years).
  - This mapping requirement is over and above the *Operational Planning Regulation* and the *Logging Plan Guidebook,* which only ask that permanent and temporary access structures be mapped.

Permanent access definition:

"Permanent logging trails include unbladed logging trails prescribed in an approved silviculture prescription and identified on an approved logging plan. They are required for repeated stand entries and periodic harvesting of areas where partial cutting silvicultural systems are prescribed"

~ page 2



Question #3:

- The key principle behind whether or not these trails should be designated as permanent access is ***the intent of the trails for management.***
  - If there is no intent to ever reforest these trails, they should not be part of the NAR (by definition). They are more appropriately designated as permanent access.
- Since the permanent access designation gives a more accurate picture of the intent of the trails, allowances should be made for well designed trail systems that require access beyond that suggested by the *Soil Conservation Guidebook* (7%, 3 and 5% in the *Commercial Thinning Guidebook* for the coast). The following criteria for a variance to the guidebook should be required:
  - the rationale for the trails is sound
  - the trails are well planned and located
  - disturbance on the trails is minimized
  - there is no added risks to other resource values
  - disturbance between the trails is negligible.
- By keeping the disturbance low on the trails, they could have been designated as NAR disturbance if the district manager is uncertain how to handle this situation now in the initial stages of Code implementation. This designation may be changed in the next entry to permanent access once the approach has become accepted practice.

Soil conservation issues:

Roads, landings and skid trails

Roads/ landings (% total area)	Skid trails (% total area)	Countable soil disturbance on the skid trails (% total area)		
		Impressions	Extensive uniform compaction	Total
2.5	7.2	0.6	1.4	2.0

Note: No soil disturbance was counted between the trails.

Overhead: Commercial thinning soil conservation Case study #1

Background Information:

This area is in the ICHmw2 (Interior Cedar/Hemlock – moist warm subzone), east of Vernon, BC. The stand here originated from a large fire near the turn of the century. As with the portions of this block that were logged earlier, this area had an overstory mixture of mostly Douglas-fir and larch, with minor components of spruce and white pine depending on site drainage. The understory had a fairly uniform stocking of redcedar, with minor amounts of hemlock and spruce. Original stand volume was about 300 m^3/ha on 45 m^2/ha of basal area. This two-storied stand was very dense, with vigour declining in many overstory stems.

Soils are well-drained deep loams to sandy loams and slopes throughout the area range from 0 to 15%.

The *Soil Conservation Guidebook* recommends:

Permanent access maximum – 7%

Dispersed NAR disturbance maximum – 10%

The Commercial Thinning Treatment

The area to the south of the middle road was commercially thinned as a preparatory cutting last year. The intent is to enter the stand several times over the next 30–40 years to commercial thin and then eventually create small openings to encourage an uneven-aged structure. This first preparatory cutting was intended to improve the vigour and height to diameter ratios of the leave trees so that they will be much more resistant to windthrow in future cuttings (a low thinning).

The thinning reduced basal area, between the skidtrails, to about 30 m^2 on 1100 dominant and co-dominant Douglas-fir and larch per hectare. Diameters of these trees range from 12.5 to 32 cm while heights range from 13 to 17 m.

The skidtrails were prelocated at roughly a 30 m spacing (see aerial photo below). Skidding equipment were restricted to use on the skidtrails. Trees were felled directionally at an angle to the trails and then winched to the trail for skidding.

Certainly the aerial photo presented previously would suggest an extensive network of trails, mainly because the trails are exposed through removal of forest canopy along the trails. As the adjacent crowns grow over the trails, which average 3 m in width, the trails will not be so apparent.

If we use the existing (1995) soil conservation guidelines and the categories for non-compliance soil disturbance, very little such disturbance can be attributed to the trails — about 2% (only 28% of the skidtrail surface). This is due in part to skidding in a very dry part of the summer. Also, considerable topping and limbing was done on the trails, giving the skidder a protective slash mat to operate on. This slash should decompose to provide a thick soil wood/humus mat for future entries. If such a running surface can be maintained, the impact on future growth should be minimal.

Questions:

1. Based on the information provided, should the skidtrails be counted as permanent access or dispersed area within the NAR? Be prepared to provide a rationale for your decision.
2. Would your answer change if this was a one-shot commercial thinning prior to a clearcut harvest in 25–30 years?
3. Based on your answers to questions 1 and 2, do you have *any rules of thumb* that can be applied when making decisions about the designation of permanent access for unbladed skidtrails?

Commercial thinning: Soil conservation compliance issues

4. **Closely-spaced unbladed logging trails:**

Case Study #2

Overhead: **Thinning/Soil disturbance**
Case study #2

Facilitator: Turn to your neighbour exercise – Allow the participants time to read the case study and discuss the attached questions.

10 minutes

Flip chart:

1. Debrief the case studies being sure to touch on the key points below, placing key points on the flip chart. Use the overhead with the map of the trails to help illustrate points.

Key Points:

Case #2

- Any potential "heavy impact" trail that will be used in the next entry for skidding could be designated as permanent access. This would include main speed trails used by grapple skidders, when horses or excavators bring the wood to the trail, or any other situations where main trails are used.
- The permanent access designation could be changed to temporary access in the next entry (if a clearcut), and rehabbed after logging.
- The secondary trails should be designated as dispersed NAR disturbance due to their low impact. Also, the next harvest (final harvest) may not necessarily utilize these trails. Likely the final harvesting will be done using fewer trails and will probably utilize different logging technology to address the larger timber (e.g., hoe forwarding).

Commercial thinning soil conservation – Case study #2

Background Information:

This area is in the CWHxm (Coastal Western Hemlock — very dry maritime variant), west of Duncan, B.C. This second growth Douglas-fir stand is 60 years old originating from natural regeneration after the original harvest. Preharvest stand volumes averaged about 1000 m^3/ha over about 80 m^2/ha basal area on 950 stems/ha.

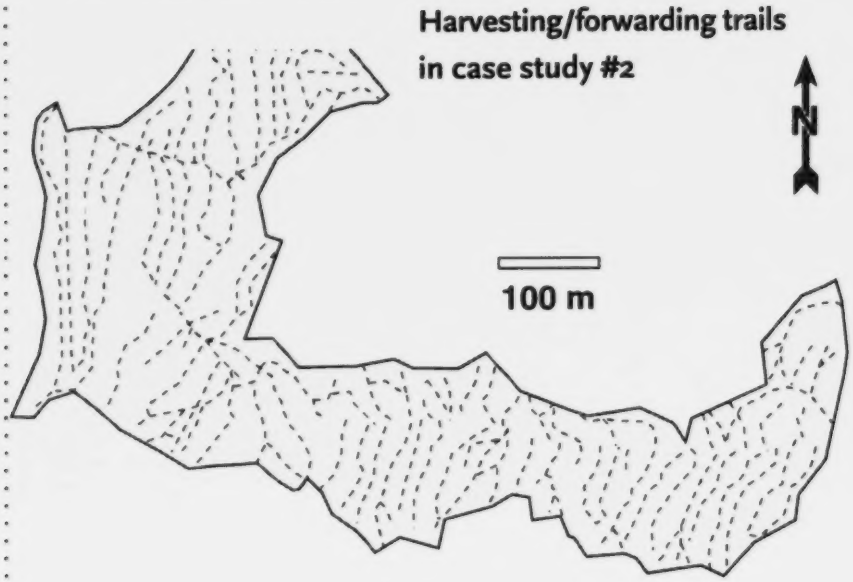
Soils are well drained deep sandy loams and slopes throughout the area range from 0 to 20%.

The Commercial Thinning Treatment

The area was thinned from below concentrating on cutting intermediates and smaller co-dominants less than 30 cm in diameter using a single-grip harvester/fowarder combination.

The thinning reduced basal area to 50–55 m^2/ha on 350 stems/ha, leaving 700 m^3/ha of volume on-site.

Trails were located and cut by the harvester operator based on the reach of the boom, and by operator preference. Trails were spaced at 15–20 m apart (see map) which is typical for this type of equipment in a commercial thinning operation. Trees were felled, delimbed and bucked to length using the single-grip head on the harvester. Wherever convenient, stems were processed on the trail in front of the machine to provide a slash mat for the machine to travel on. Logs were piled to the side of the trail to be picked up by the self-loading forwarder. The forwarder can pivot the cab 180 degrees to allow the machine to be easily backed into the stand empty and driven forward out of the stand loaded.

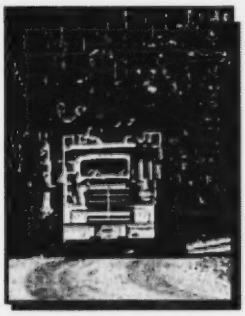


The total area covered by the harvesting/forwarding trails totaled 22%. However, note that only a small percentage of the secondary forwarding trails showed impact from the machinery. Only 25% of these secondary trails were affected according to the categories of disturbance outlined in the *Soil Conservation Guidebook*. On the main forwarding trails, most of the trails were heavily affected. However, only a small percentage of the trails qualified as main speed trails.

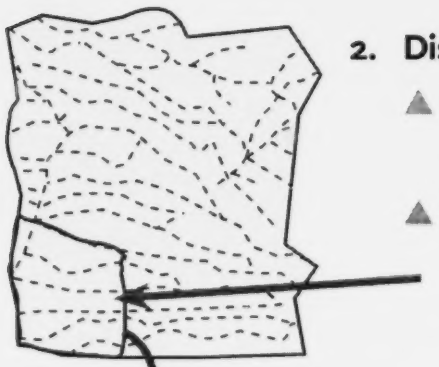
Questions:

1. Based on the above discussion how should the trails be designated in terms of permanent or dispersed disturbance? Explain your rationale.
2. Based on your answers to question #1, do you have any additional *rules of thumb* that can be applied when making decisions about the designation of permanent access for unbladed skidtrails?

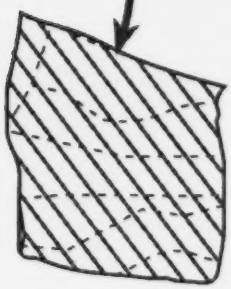
Compliance assessment procedures for soil conservation



1. Permanent access structures
   - ▲ Inspection to compare with LP and SP
   - ▲ Formal survey if required
     - – absolute measurement of area



2. Dispersed NAR disturbance
   - ▲ Visual inspection
     - – ID questionable areas
   - ▲ Questionable areas stratified
     - – min. 1.0 ha stratum



- ▲ Formal compliance survey
  - – gridpoint systematic sampling

Overhead: Compliance assessments for soil conservation

Facilitator: Review the main points quickly

Key Points:

- Compliance will be assessed for soil conservation in commercial thinning using all of the same methods and procedures as for other harvesting operations. The procedure is as follows:

Permanent Access:

- The enforcement officer inspects the permanent access structures looking for more area in access than is indicated on the logging plan. He may make some measurements here.
- A formal compliance assessment would measure these structures in detail to determine the absolute disturbance. This would be done if the enforcement officer suspects that permanent access is greater than the SP standard.

Dispersed NAR Disturbance:

- Enforcement officer inspects harvested block looking for areas that appear marginal in terms of dispersed NAR disturbance.
- These areas would likely include:
  - unbladed trails that are on the logging plan as NAR disturbance, but appear heavily impacted.
  - other disturbance — unbladed trails that are not on the logging plan or disturbance between trails.
- If marginal areas of 1.0 ha or greater exist, a full compliance survey will be ordered on these areas. Note: these disturbed strata cannot just follow the skidtrails. They would have to include at least several skidtrails and the area between them.
- A certified soil disturbance surveyor will assess those areas (or the entire block) where compliance is questionable using the standard assessment procedures outlined in the *Soil Conservation Surveys Guidebook.*
- These procedures will include a gridpoint systematic sampling on uniformly spaced transects that are run perpendicular to the logging trails. This assessment will have a statistical analysis of data attached and will be submitted to the DM for determination of appropriate administrative remedies, where appropriate.

How can we ensure compliance with SP standards for soil conservation?

Compliance

Key Points...

Overhead: **How can we ensure compliance?**

Facilitator: Review the main points quickly

Key Points:

- Prelocate your trails carefully and GPS them for mapping on the logging plan.
- Keep the equipment on the trails.
- Minimize disturbance on the trails by:
  - using the right equipment at the right time (season). Small lightweight equipment is generally best. If soils are especially sensitive or slopes are steeper, consider a small skyline.
  - top and limb on the trails as much as you can (at least for the timber that is felled to the trails). Skidding or forwarding on this slash will reduce impacts.
  - do not blade off any rotten wood deposits. Try to smooth it out and skid over it, using it as a protective mat.
  - use puncheon or rubber mats on significant persistently moist sections of trails.

Leave tree characteristics and stand damage

Key issues:

1. **Insufficient leave trees**
2. **Poor leave-tree selection**
3. **Stand damage**

FOREST PRACTICES CODE

Silviculture Practices Regulation – Section 12(1)

"A person must ensure that *sufficient trees remain standing and undamaged to meet the resource management objectives* for the area specified in any higher level plans, if the person carries out a *commercial thinning treatment* under a silviculture prescription."

Sanctions: **Administrative penalty up to $5,000 per tree.**

Overhead: **Leave tree characteristics and stand damage issues**

Facilitator: There are three key issues that compliance assessments will try to address:

1. Insufficient leave trees.
2. Poor leave tree selection.
3. Excessive stand damage.

The legislative basis for these inspections is mainly:

The Silviculture Practices Regulations – Sec. 12. (1):

> *A person must ensure that sufficient trees remain standing and undamaged to meet the resource management objectives for the area specified in any higher level plans, if the person carries out a commercial thinning treatment under a silviculture prescription.*
>
> Sanctions: Administrative penalty up to $5000 per tree

How will leave tree characteristics be assessed for compliance?

1. Visual inspection
   - ▲ noting general condition
2. Establish plots
   - ▲ where densities or characteristics appear marginal
   - ▲ leave trees must meet SP criteria for characteristics and density

Note: If density is too low...

- ▲ the stratum may be considered NSR
- ▲ penalty plus new SP to reforest the area

Overhead: **How will leave tree characteristics be assessed for compliance? See Appendix 3 in the *Commercial Thinning Guidebook***

Facilitator:

Leave tree characteristics:

- The enforcement officer will walk through the stand assessing its general condition and the number of stems per ha. Where necessary, plots may be established to get a rough estimate of densities, etc.
- Where final densities or leave tree selections appear marginal, sample plots will be established similarly to the Thinning Quality Plots.
- Final leave tree density will be expected to be above the minimum suggested in the SP. Leave tree characteristics should also fall within the ranges specified in the SP.
- The enforcement officer may stratify out an area within the block where leave tree selection appears marginal. Such areas will be a minimum of 1 ha in size.

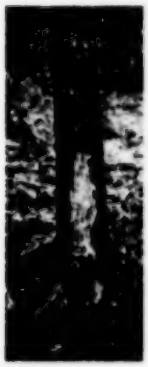
Note:

- If density is too low, the block or stratum will also be considered NSR.
- In addition to penalties assessed for insufficient leave trees, a new SP to reforest the area will be required.

The conceptual basis for stand damage concerns

Wounds occur as a result of:

- falling
- skidding, yarding and forwarding
- windthrow and snow breakage



The problems:

- pathway for decay fungi to enter
- stress increases the activity of existing decay fungi
- wound and decay lowers value of log

Reaction:

- compartmentalization to create a barrier
- chemical barriers – resins in conifers
- cover wound with new tissue

Overhead: **The conceptual basis for stand damage concerns?**

Facilitator: What about assessing stand damage? We should back up a bit and first discuss why we are concerned about damage.

Read:

Read pages 25–27 In the *Commercial Thinning Guidebook* to get an overview of the effects of tree wounding.

Wounding can occur as a result of:

- falling
- skidding
- associated windthrow and/or snow press afterwards

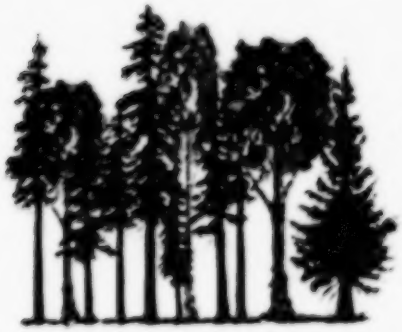
Wounding during commercial thinning creates two problems for a tree:

- Wounds provide a pathway for some decay fungi to enter the tree.
- Wounds may allow decay fungi to become more active as the stress of trying to recover from injury diverts internal resources away from tree defenses.

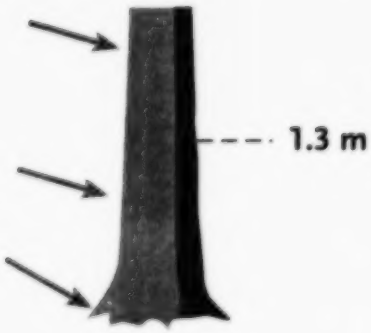
Reaction to wounding:

- Trees do not heal wounds – they compartmentalize the damage to create barriers to resist colonization by decay fungi.
- New tissue must cover the wound. This will take time, although the cambium is generally more active around the wound than in other parts of the tree.
- The longer wounds remain open, the more opportunities there are to colonize the tree.

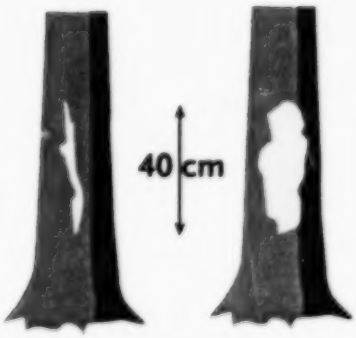
Factors affecting decay development



1. Tree species
   - resinous wood?
   - bark thickness



2. Wound location
   - height above or below dbh
   - proximity to soil



3. Size and type of wound
   - total size
   - width
   - scar or gouge

Overhead: Factors affecting decay development in wounds

Facilitator:

Tree Species: (see page 26 in the *Commercial Thinning Guidebook*)

- Thin-barked species with non-resinous wood, such as true firs, spruce and hemlocks are more readily infected through wounds than thick-barked species with resinous wood (Douglas-fir).
  - The resins are transported to the site of a wound, discoloring it and making the wood somewhat toxic for microorganisms and more or less impervious to water. Over time decay fungi may still be able to grow through this.
- Resinous species like lodgepole pine, even though they are thin-barked, are still much more resistant than non-resinous species.

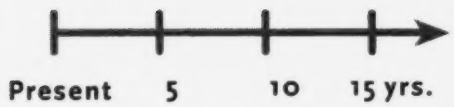
Location of Injury:

- Wounds below breast height are more likely to become infected possibly due to microclimatic effects.
- Incidence of decay declines with increasing height, although some species (like larch) more frequently become infected through broken tops and branches than through basal scarring (this is most likely related to the bark thickness and its resistance to scarring).
- Root wounds and stem wounds contacting soil nearly always become infected, regardless of size, and they have faster decay rates.

Size and Type of Injury:

- Probably the most important characteristic.
- In wounds greater than 900 cm^2, between 60–80% of western hemlock, spruce and true firs become infected.
- Wide scars tend to have twice the decay loss as narrow scars.
- Gouges (deep or splintered wounds into the xylem) have more decay losses than smooth wounds (scars where only the bark is removed).

Factors affecting decay development



4. Age of injury
   - ▲ how long before you are harvesting again?

5. Season of harvesting
   - ▲ avoid spring sap-flow period

6. Wound dressings?
   - ▲ generally no benefit

Overhead: Factors affecting decay development in wounds

Facilitator:

Age of Injury:

- Wounds less than 10 years old generally have no decay as insufficient time has passed to allow proper development.

Season of Injury:

- Generally, avoid the spring sap-flow period as the bark tends to be loose and more easily damaged. Although there is conflicting reports about the success of decay colonization at this time, you should generally avoid this season since wounding tends to increase along with wound size (all other things being equal).

Wound Dressings:

- Benefits are highly questionable. Most European studies (where they have used this) indicate that even dressings with systemic fungicides only offer up to one year protection, and even this protection is limited. Infections after a year in a German study indicated 40–70% infection. As these dressings crack and peel over time the entry for decay becomes even more easily facilitated.
- Generally treatment benefits do not outweigh treatment costs.
- Has been done for years in urban areas, but may be mostly for "window dressing" – the appearance of something protective.

Impact of wounding decay

Wounding and decay can cause or contribute to mortality

- **lower tree vigour – much more susceptible to other damaging agents**

Decay can significantly degrade log value

- **decay associated with large wounds may double every 10 years – hemlock and true fir**

Wound along may degrade value

- **especially in butt logs**

Overhead: Direct impact of wounds

Facilitator:

Wounding can directly cause or contribute to mortality.

- ▲ It may lower tree vigour to the point where it is much more susceptible to other damaging agents (insects, disease, etc.).

Decay can significantly degrade log value.

- ▲ Beginning 3 years after injury, decay in hemlock and true firs can double every 10 years in wounds larger than 900 cm^2.
- ▲ Eight years after wounding, decay volumes in wounds larger than 900 cm^2 in Sitka spruce may double every 3 years.

Just the wound can degrade the butt log significantly.

- ▲ If the wound is severe enough. Remember, the butt log potentially has the highest value.

Minimum damage standards

Maximum individual scar size

- 400 cm2 (20 cm x 20 cm), OR
- 1/3 tree circumference

Maximum cumulative scars per tree

- 900 cm^2

Supporting root >2 cm

- no scars <100 cm from base of stem

Small scars

- no more than 10% of leave trees to have scars 400 cm^2

Gouges

- no gouges on stem or major

Crown damage

- no reduction in crown mass of >25%

Overhead: Minimum damage standards

▲ What constitutes significant damage to a tree?

Facilitator:

As you can see, some damage will be viewed as insignificant, because of size, etc. The questions then becomes "What will the Ministry view as significant or countable damage?"

These are considered faults in a thinning operation – they are summarized on page 46 in the *Commercial Thinning Guidebook*.

Minimum damage standards have been set to designate damaged trees as follows:

- ▲ Individual wound size should not exceed 400 cm^2 (20 × 20 cm) or be greater in width than 1/3 the circumference of the tree.
- ▲ Cumulative wound size per tree – applies to multiple scarring situations. Acceptable up to 900 cm^2.
- ▲ Wounding on a supporting root (>2 cm) should not occur less than 100 cm from the base of the stem (outside bark).
  - – This includes a wound of any size (exposed xylem will qualify).
- ▲ Gouges (damage into the cambium) should not occur anywhere on the tree.
- ▲ Wounding (all types – including less than 400 cm) should not affect more than 10% of all leave trees.
- ▲ Live crown mass should not be decreased by more than 25%. This is a highly subjective ocular estimate.

Less than 10% of the crop trees with scars of less than 400 cm^2 – this is determined by surveying the entire stratum or block (see page 70 of the *Commercial Thinning Guidebook*).

Compliance inspections for stand damage

Target = Zero Damage

1. **Visual inspection**
   - ▲ identify concentrations of damage
   - ▲ absolute tally of all damaged
2. **Inspection plots**
   - ▲ damage trees tallied in plots to determine leave trees
3. **Determining compliance**
   - ▲ non-compliance will result when:

acceptable leave trees/ha — **damaged trees/ha are** < **minimum density of leave trees in SP**

Overhead: Compliance inspections for stand damage

Facilitator:

▲ The goal of the Ministry of Forests is to have "zero stand damage." However, it is recognized that some logging damage is likely inevitable and often it will be insignificant relative to the ability of the stand to meet the management objectives set.

Procedure:

1. **Visual Assessment Method** – the inspector will walk through the area and identify any concentrations of damage (usually along skidtrails).

   ▲ These areas may be stratified out with an absolute assessment and tally of all damaged trees conducted.

2. **Formal Plots** – Stand damage will also be assessed as a percentage of the total trees in any formal inspection plots.

3. In your SP you will designate the minimum number of acceptable leave trees (trees with no faults). The way to determine if you have met the objective is by using the formula:

   Acceptable leave trees/ha – damaged trees/ha >min density of leave trees specified in the SP (as per page 44 of the *Commercial Thinning Guidebook*). If this condition is met, you are within the tolerance identified in the prescription. If not, you are subject to an administrative penalty.

How do we make it work?

Small group exercise – 15 minutes

Consider:

- choice of equipment, operator, season, etc.
- preplanning – the SP, layout, logging plan, harvesting contracts, etc.
- harvesting operations
- monitoring

Overhead: **How do we make it work?**

Facilitator:

1. **Small Group Exercise:** Allow the participants in groups of three or four to consider the question in light of the various considerations and provide some suggestions (15 min).
2. Debrief the suggestions with the flip chart
3. **OPTION: IF TIME** – one group presents findings under each category.

Key Points:

Choice of equipment, operator, season of logging, etc.

- ▲ Equipment must match the site, the stand and the stand structural objectives in the prescription.
- ▲ Operators are professional too! Walking the ground before the layout (and even the development of the SP) may allow you and the operator to develop a strategy together to achieve your objectives.
- ▲ The operator must be made aware of all of your objectives and constraints (obligations for compliance under the Code).
- ▲ Choose an appropriate operator (if you have that flexibility). There is no room for highball operators in a partial cutting situation. Cautious, careful operators who are very concerned about quality of work are best suited for this work.
- ▲ Remember, most operators are used to clearcutting where production or the amount of wood in a landing was what counted at the end of the day. Now you must turn that focus around to the leave trees and the residual stand condition.
- ▲ Generally the best season will be outside of the spring sap-flow period, when ground conditions are suitable with respect to your soil conservation objectives. This will depend on the site and the equipment being used.
- ▲ Winter in the interior is often favoured to reduce impacts on soil. Remember however, that under very cold weather crown branches are quite brittle, breaking much more easily.

Pre-planning – the SP, layout and the logging plan

- The SP should state a range of densities that allow for some choices and damage.
- Trails and corridors should be spaced close enough to keep the stand damage low (although you must also consider soil conservation).
- Generally speaking, this spacing should be 20–40 m, depending on the equipment used (single-grip harvesters need 20 m spacing), and the stand (interior stands tend to have higher residual densities with smaller timber so trails tend to be closer together).
- As a general rule it is best to enter the stand for the fewest entries you can get away with, but this will also depend on your objectives.
  - Often due to windthrow hazard and or management objectives, you may have to open up the stand through several entries over time rather than one.
- Trails and/or corridors must be laid out to consider the equipment capabilities.
- Trails should be as straight as possible.
- Trails should converge or intersect at an angle.
- Designate rub trees along trails and corridors, marking them to be left until the end of the skidding or yarding operation.
- Yarding corridors should be established perpendicular to contours, with adequate deflection and length for good log control.

Falling and harvesting

- Directionally fall trees herringbone style to the skidtrail to facilitate easy winching.
- Fallers should watch for trees damaged during falling and substitute similar leave trees where damaged trees were supposed to be left.
- Fallers should maintain enough leave trees to remain significantly above the minimum leave tree density (but not over the maximum) to allow some extra leave trees to compensate for losses due to damage.
- Top, limb and buck to length at the stump.
- Where an unanticipated rub tree develops, leave it until the end of skidding on that trail.

- Where leave trees appear very vulnerable, use slash, logs, or artificial protection devices (tires, culverts, tires, rubber mats) to protect the bole and major roots from damage.
- Remove damaged trees along trails (or between trails) at the end of the skidding on that trail. This can become more difficult and costly along corridors in skyline operations as you must shut down the yarder while falling occurs.

Monitoring

- It is critical to specify clearly the expectations for densities of leave trees, and damage standards to the fallers during the pre-work conference at the start of the project.
- Walk a bit of the area and discuss strategies to reduce damage before the project starts.
- **Monitor very closely, especially inexperienced operators at the beginning of a project. Subsequent monitoring will depend on their performance. Make sure that the logger is consistently above the minimum allowed density to allow for some damage.**
- Walk all of the trails during the project to ensure that damaged trees are removed.

Lesson 6 From Prescription to Implementation

Some of the basics

60 minutes

Objectives:

1. To introduce thinning definitions.
2. To go over a completed prescription.
3. To ensure that participants are aware of the level of detail expected in a CT prescription.
4. To provide an overview of the parts that link the prescription to the ground.

Equipment Needs:

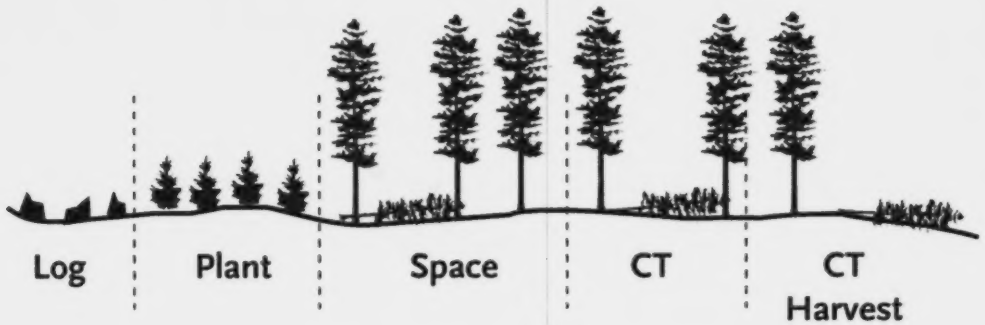
- ▲ flip chart
- ▲ overhead projector

Method:

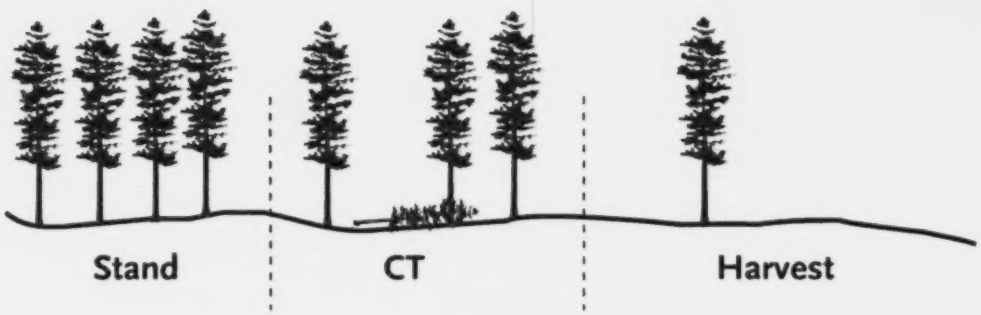
- ▲ lecturette
- ▲ exercise
- ▲ handout of completed example

CT – Two Ends of the Spectrum

Prescription 1



Prescription 2



Overhead: **CT – the two ends of the spectrum**

Facilitator: Go over the following two scenarios.

Creating a Commercial Thinning Regime.

There are two different situations.

- The first is to create a regime from scratch; that is, harvest the stand and stock it based on planned entries that include a CT entry. This may also include a juvenile spacing entry prior to CT, fertilization – the works. This form of regime will come with time as we have clearer objectives and more second-growth harvest. You will create these regimes in SPs and SMPs that will direct future CT entries.
- The second situation is where you inherit a stand that is a candidate for CT. You must then determine its feasibility, create a prescription for the CT and estimate the time until the final harvest.

Note: The first situation will not be driving present commercial thinning prescriptions. The second situation is where most commercial thinning prescriptions will emerge for the near future. We will therefore cover the second option here.

Overhead: **Creating your prescription – some concepts and terms that you will be using.**

Facilitator: Have the participants turn to page 8 in the *Commercial Thinning Guidebook* and have them read the four definitions for thinning types.

Flip chart: If there are any questions, draw diagrams of the various thinning types on the flip chart.

Ask: What thinning types are likely going to be accepted by the Ministry of Forests – and why?

- Thinning from below as it conforms with the points outlined in the preamble to the Forest Practices Code.

Code preamble: Whereas British Columbians desire sustainable use of the forests they hold in trust for future generations; and whereas sustainable use includes:

- managing forests to meet present needs without compromising the needs of further generations,
- providing stewardship of forests based on an ethic of respect for the land,
- balancing productive, spiritual, ecological and recreational values of forests to meet the economic and cultural needs of peoples and communities, including First Nations, and
- restoring damaged ecologies.

Go over Other types of thinning may also be appropriate depending on the stand conditions (overstorey removal with tolerant species beneath). The key would be to keep damage to a minimum. Often, it is necessary to harvest some of the codominants and possibly dominant trees along with thinning from below to make the entry economic (mix of low and crown or selection thinnings).

In your SP In your SP you will want to describe the type of thinning you plan using – one or a combination of the four methods described. For example, the block will be harvested using a combination of a low and crown thinning with the emphasis on thinning from below.

This is not enough: To describe what you are going to do you need more of a description. An additional method is to provide a d/D ratio.

Introduce the d/D ratio:

Use the flip chart: This ratio is a common quantitative description of thinning type.

d = mean DBH of cut trees

D = mean stand DBH before thinning

▲ Low thinnings (where the mean of the cut trees will be less than mean of the stand before thinning) will result in a ratio of less than 1 (e.g., 25 cm/35 cm).

A d/D ratio of >1 would be from selection thinnings and possibly crown thinning.

WINSTIM uses d/D ratios when the stand is thinned. They describe the ratios as follows:

< 1 – thinning from below

> 1 – thinning from above

= 1 – uniform thinning.

Note: Often CT results in a uniform spatial distribution of residual trees in either the low, crown or selection thinnings.

Ask: Why is the type of thinning important?

The effect on post CT growth can be significant. Taking the best trees can result in much reduced potential yield (see guidebook p. 7, Larson and Cameron 1986 reference). High grading does not fit the preamble of the code.

What else should you do?

▲ Create a stand and stock table that shows the stand before logging and the post-logging stand. Refer to the *Stand Density Management Guidebook* for examples???

Exercise:

▲ Go over a completed example from a real SP.

Tail gate exercise – making it work

(Optional field exercise – depending on time, weather and logistics)

Exercise: From prescription to the ground – An exercise with four sets of hats.

The objective of this exercise is to provide the participants an opportunity to go through completed examples of an SP, a marking contract, and a logging plan and to point out the relevant information for those who will be implementing the plan on the ground.

People will be broken into groups of four, then two. The groups of two (Pair #1 and Pair #2) are provided with one of two tasks: both pairs will be given 45 minutes to research their task and given 20 minutes to go over it with the contractor. We will do a wrap-up with the entire group afterwards.

Total time is 45 + 20 + 20 + 20 wrap-up = 1 hour and 45 minutes.

In the participant's workbook are the following instructions:

Task one – You and your partner (lets call you Pair #1) have been asked to take a green (inexperienced) tree-marking contractor to the site. Your task is to ensure that the contractor is familiar with all relevant information in the SP and marking contract that you have. These two documents are found in section xx of the participant's workbook. You have 45 minutes to go over the documents and highlight pertinent information. Once you have done this you have 20 minutes to present your information to the other group. The presentation should resemble a tailgate session. The other pair (Pair #2) will ask questions and want clarification; it is your job to get the information across so they can understand what they will be doing, what they need to do to get paid and what fines are applicable and when.

Task two – While Pair #1 is preparing for their tree marking overview, Pair #2 have been asked to review the logging plan and present the requirements to the green (inexperienced) logging contractor who has won the bid for the block. Forty-five minutes have been provided for you to go over the logging plan and highlight issues that the logger should be aware of. You will then be given 20 minutes to go over this information with the loggers. The other pair (Pair #1) will act as the loggers and question you to ensure they are sure of their responsibilities.

Note: If you have any questions during phase 1 of this exercise, the facilitator will be circulating to help you.

The role of green contractors is to ask questions and ensure they are clear on all aspects of their job. This includes penalties and variances allowed. Due to time constraints, please no hang-over excuses, or really thick contractors. This group, while green, are keen.

The timing of this is:

45 minutes – both pairs prepare for their tailgate meeting

20 minutes – Pair #1 presents to Pair #2 (who will act as green tree marking contractor)

20 minutes – reverse roles Pair #2 presents to Pair #1 (who are the green logging contractor)

20 minutes – review issues, go over suggestions and wrap-up as a group.